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ä	far, father
ā	fate, hate
a or ă	at, fat
ã	air, care
ạ	ado, sofa
â	all, fall
ch	choose, church
ē	eel, we
e or ĕ	bed, end
ė	her, over: also Fr. *e*, as in *de; eu,* as in *neuf;* and *oeu*, as in *boeuf, coeur;* Ger. *ö* (or *oe*), as in *ökonomie.*
ȩ	befall, elope
ē	agent, trident
ff	off, trough
g	gas, get
gw	anguish, guava
h	hat, hot
ḳ or ʜ	Ger. *ch,* as in *nicht, wacht*
hw	what
ī	file, ice
i or ĭ	him, it
ỉ	between e and i, mostly in Oriental final syllables, as, Ferid-ud-din
j	gem, genius
kw	quaint, quite
ṅ	Fr. nasal *m* or *n,* as in *embonpoint, Jean, temps*
ñ	Span. *ñ,* as in *cañon* (căn′yŏn), *piñon* (pēn′yŏn)
ng	mingle, singing
nk	bank, ink
ō	no, open
o or ŏ	not, on
ô	corn, nor
ȯ	atom, symbol
ọ	book, look
oi	oil, soil; also Ger. *eu,* as in *beutel*
ö or oo	fool, rule
ou or ow	allow, bowsprit
s	satisfy, sauce
sh	show, sure
th	thick, thin
ᵺ	father, thither
ū	mute, use
u or ŭ	but, us
u̇	pull, put
ü	between u and e, as in Fr. *sur,* Ger. *Müller*
v	of, very
y	(consonantal) yes, young
z	pleasant, rose
zh	azure, pleasure
′(prime), ″(secondary)	accents, to indicate syllabic stress

THE ENCYCLOPEDIA AMERICANA

H

HAWAII, hā-wī'ē, a Territory of the United States; geographically, the HAWAIIAN (formerly SANDWICH) ISLANDS, the northeasternmost group of the Pacific, lying near the northern edge of the tropics (lat. 18° 54′ to 22° 15′ N.; long. 154° 50′ to 160° 30′ W.), 2,100 miles southwest of San Francisco. It consists of eight inhabited islands, viz., Hawaii, Maui, Kahoolawe, Lanai, Molokai, Oahu, Kauai and Niihau besides several rocky islets. They extend from Hawaii on the southeast 390 miles to Kauai on the northwest, and are continued in a chain of islets, sand banks and shoals 1,200 miles farther to Midway Island. The total area of the group is 6,454 square miles, of which Hawaii contains nearly two-thirds or 4,015 square miles; the next island, Maui, 728; the third, Oahu (which takes the lead in wealth and population, and contains the capital and chief seaport), 598; and the fourth, Kauai, 547 square miles.

Topography.— The islands are entirely volcanic, consisting in fact of the summits of a gigantic submarine mountain chain rising from the bottom of the ocean, which is three miles deep within 30 to 50 miles from the shores. The volcanic action seems to have moved from northwest to southeast, Kauai being the oldest island.

The last but one, Maui, contains the vast extinct crater of Haleakala, which is at its highest point 10,032 feet above sea-level, 20 miles in circumference and 2,000 feet deep; while Hawaii is made up of four volcanic mountains, Mauna Kea (White Mountain), 13,805 feet high, the loftiest peak in the Pacific; Mauna Loa (Long Mountain), 12,675 feet; Hualalai, 8,273 feet; and Kohala, 5,490 feet high. Of these Hualalai has been dormant since 1801, but Mauna Loa is still active at intervals, having an oval summit crater, 9.5 miles in circumference, with nearly vertical inner walls 500 to 600 feet high. Twenty miles to the southwest is the famous crater of Kilauea, eight miles in circumference and 4,000 feet above the sea. It is almost constantly in action.

The windward sides of Oahu and Molokai, and the northwest side of Kauai, present precipices 2,000 feet in height, while the northeast slopes of Hawaii and Maui end in bluffs several hundred feet high, furrowed by deep and narrow canyons cut by the streams. "In West Maui and Kauai may be found valleys that almost rival Yosemite" (Dutton). Coral reefs line the greater part of the shores of Kauai, Oahu and the southern shore of Molokai, but are nearly absent from Hawaii and Maui.

The best harbors are found in Oahu at Honolulu, and at Pearl Harbor, seven miles west, but Hilo Bay, Hawaii, only needs a breakwater to make a commodious harbor. The only rivers worthy of the name are found in the island of Kauai. Several of them were formerly crossed by ferries.

Climate and Rainfall.— The climate of the islands is much cooler than that of other countries in the same latitude. This is due not only to the northeast trade winds, which blow 9 or 10 months in the year, but also to the return ocean current from the region of Bering Straits. At sea-level the mean temperature is 73° F., the maximum and minimum being 89° and 52°, respectively. The islands are entirely exempt from the cyclones which so often make havoc in the central and western Pacific. The contrast in climate between the windward and leeward sides of each island is very striking, the northwest slopes being rainy and heavily wooded, while the opposite coast has a warm and dry climate. From the differing elevations and exposures there is an extraordinary variety in the rainfall even within narrow limits. Thus the annual rainfall in the district of Hilo, Hawaii, averaged 136 inches in 20 years, from 1880 to 1900, while in Honolulu it averaged 30.9 inches, and at Luakaha, in the valley back of Honolulu, 128.9 inches.

Production and Industries.— The Hawaiian Islands, from the lack of coal and metals, are an agricultural country. There are, however, according to recent statistics, 500 industrial establishments in the Territory, employing a total of 7,572 persons.

The soil of the islands in general is poor, with the exception of the valleys and some of the coast plains, which are of limited extent. The greater part of the interior consists of rugged, barren mountain sides, extensive tracts covered with lava, and forest land, which needs to be protected for the preservation of the water supply. Extensive tracts of formerly barren land, however, have been made productive by irrigation and the use of fertilizers. On Oahu there are over 200 artesian wells, yielding daily from 250,000,000 to 300,000,000 gallons, and on some plantations pumps are employed which raise over 10,000,000 gallons of water a day, and in some places to an elevation of 350 feet.

In Kauai electricity generated by water-power in the Wainiha Valley is carried 30 miles by wire to run the pumps of the McBryde plantation. Extensive aqueducts have been made in western Kauai, Maui and northern Hawaii, consisting largely of tunnels driven generally through solid rock. Numerous reservoirs have also been formed by damming the canyons. The Planters' Association employs a large staff of experts in chemistry, entomology and scientific agriculture, with the result that the yield of sugar per acre is the highest in the world. The average annual yield is four and one-half tons per acre, but the average for irrigated plantations is six tons to the acre. The total crop for 1914 was over 617,038 tons. Only Java and Cuba have a greater gross product. The power for the sugar mills is obtained entirely from burning the bagasse or cane refuse. The sugar is so completely extracted from the juice that no molasses is made, the remainder being thrown into fertilizers. The total number of employees on the sugar plantations in 1910 amounted to 44,048, including Japanese, 28,832; Koreans, 1,787; Chinese, 2,861; Portuguese, 3,752; Filipinos, 2,096; Hawaiians, 1,139; Porto Ricans, 1,941; Russians, 103; Spanish, 579; Americans, 614; others, 344.

The first importation of Chinese took place in 1852. In 1878 their number had risen to 5,916, and in 1886 to 21,000, at which time a strict exclusion act was passed. In 1878 the first Portuguese immigrants arrived from the Azores, and during the next 10 years about 7,000 of these people came to the islands, where they have given great satisfaction as industrious and law-abiding citizens. In 1886 a labor convention was concluded with Japan and a stream of immigrants set in, which increased the number of Japanese in the islands from 116 in 1884, to 24,400 in 1886, and 61,111 in 1900. Porto Ricans were imported in 1901 to the number of about 2,500. Both as laborers and as citizens they have proved to be very unsatisfactory. Beginning with the year 1903, up to 31 Dec. 1905, about 7,000 Koreans arrived in the Territory, who have done well as laborers. In the spring of 1907 several thousand immigrants were imported from Spain and the Azores, with the understanding that they should be given small freeholds of their own by the planters.

The danger of depending upon a single crop has long been recognized, and persistent efforts have been made to develop minor industries. The culture of rice was commenced in 1860, and it soon became the second crop in importance, amounting to about 15,000 tons annually of cleaned rice, most of which is consumed in the Territory. The quality of Hawaiian coffee is equal to that of Mocha, but the industry is depressed by the competition of Brazilian and Central American low-grade coffees. The crop in 1910 amounted to about 2,000 tons. The amount exported in 1910 was valued at $330,228. The pineapple canneries in 1909 had an output of 510,000 cases of two dozen cans each. There are several sisal plantations, and two promising rubber plantations. Experiments with tobacco have been successful. The castor oil bean grows wild, but the manufacture of the oil has not yet been profitable. Nearly all the fruits of the tropical and some of the temperate zone grow well in the islands, and the total export in 1910 of fruit and nuts, not canned, was valued at $1,794,001. The native staff of life is the taro root, or Colocasia, reduced to a paste called poi. There are about 20 stock and sheep ranches, which exported $56,425 worth of wool in 1910. The export of honey and wax amounts to about $40,000 a year.

Commerce.— The total exports in the year ended 30 June 1915 were valued at $62,368,356, of which amount $62,306,507 must be credited to shipments to the United States. Imports were valued at $26,064,855 ($22,772,632 from the United States). In 1915, vessels numbering 456, of 1,605,925 tons entered, and 436 of 1,574,845 tons cleared at the ports of the islands.

Transportation.— For steamship lines see article on HONOLULU. There are 20 steamers and as many schooners engaged in the inter-island trade. There are about 307 miles of railroads on the islands, the principal line being on Oahu, and others on Maui and Hawaii. The principal islands are connected by wireless telegraph, each island being encircled by telephone lines. The trans-Pacific submarine cable laid in 1903 connects the islands with both continents.

Finances.— The bonded debt assumed by the United States on annexation was $4,000,000, leaving $951,000 to be paid by the Territory of Hawaii. The debt of the Territory had increased by 30 June 1910 to $4,079,000. On 1 July 1915 it amounted to $7,873,000. The assessed valuation of taxable property had increased by 1 Jan. 1910 to $150,268,467. In 1915 it was $176,601,222. The taxes are 1 per cent on property and 2 per cent on incomes above $1,000 a year. For the year ended 30 June 1915 the receipts of the government were $2,796,146 and its disbursements $2,747,270.

Education.— There is a good free-school system, graded, with compulsory attendance from 6 to 15, with an excellent normal training school, besides industrial and high schools. The school law requires that the English language shall be the basis and medium of instruction in all schools.

The department is administered by a superintendent and six commissioners, aided by three traveling inspectors.

In 1915 there were 170 public schools with 735 teachers and 28,827 pupils; 46 private schools with 314 teachers and 7,702 pupils.

The total cost of the government schools was $841,588 for the year ended 30 June 1915. The private schools are mostly endowed, as Oahu College and the Kamehameha Schools, founded by the late Mrs. Bernice Bishop; or managed by missionary boards or religious orders, as Saint Louis College.

Charitable Institutions.—Among these may be mentioned the Lunalilo Home for aged and indigent Hawaiians, the Asylum for the Insane, the numerous hospitals, eight of which are under the Board of Health, but the most important is the leper settlement established in 1866 on a peninsula of Molokai, shut off from the rest of the island by a precipice 2,000 feet in height. The number of lepers has decreased from 1,200 to 652. The territorial government provides them comfortable homes, food, clothing and medical attendance free of cost, aided by the devoted Franciscan Sisters and the Brothers of the Sacred Heart.

HAWAII.

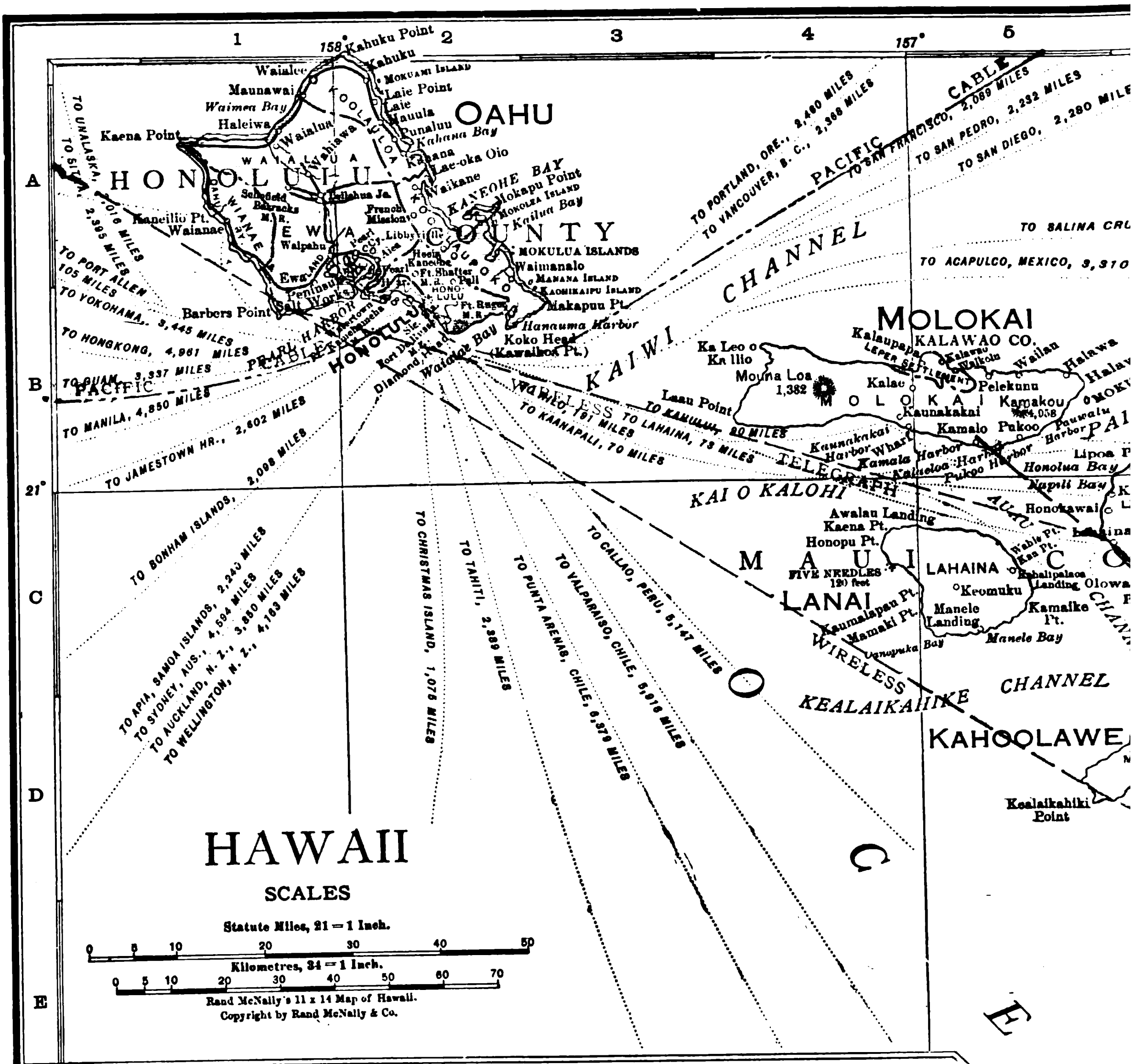
Estimated population, 215,741

ISLANDS

Pop.			Pop.		
55,382	**Hawaii**	G 9	28,623	**Maui**	B 7
2	**Kahoolawe**	D 5	1,791	**Molokai**	B 5
23,744	**Kauai**	F 4	208	**Niihau**	G 1
131	**Lanai**	C 4	81,993	**Oahu**	A 2

Cities

6,745	**Hilo**	F 10	1,000	**Lahaina**	C 5
52,183	**Honolulu**	B 2			



HAWAII

SCALES

Statute Miles, 21 = 1 Inch.

Kilometres, 34 = 1 Inch.

Rand McNally's 11 x 14 Map of Hawaii.

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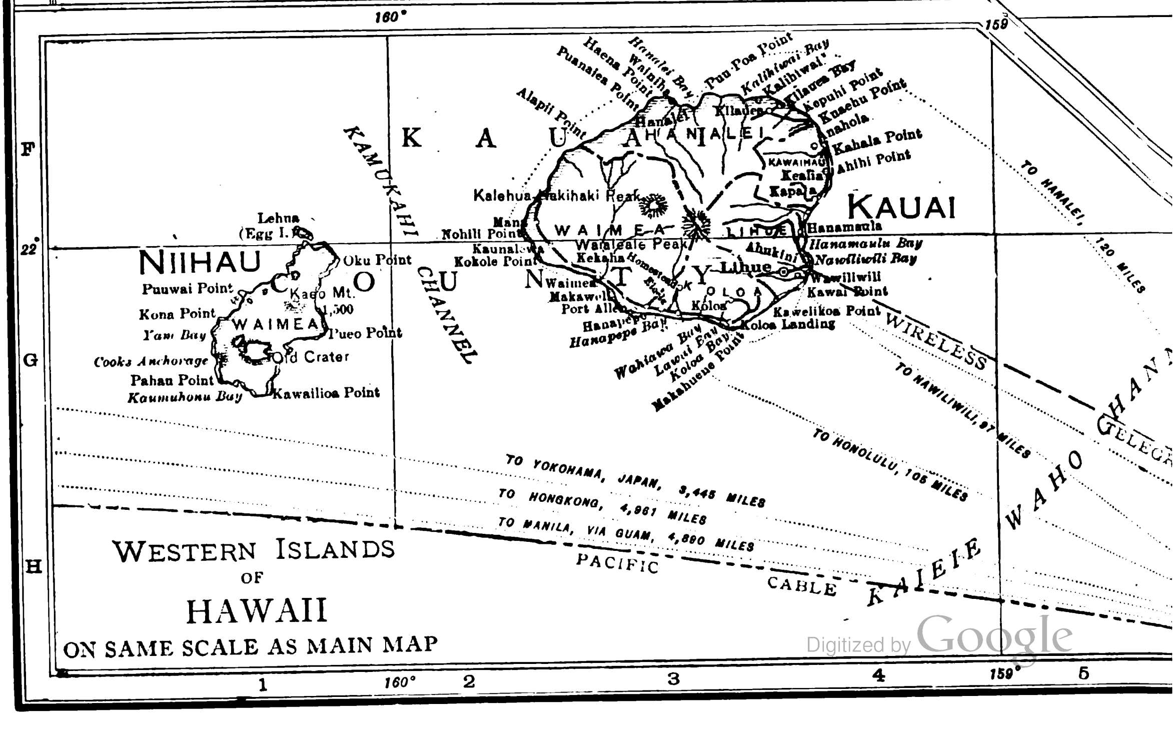
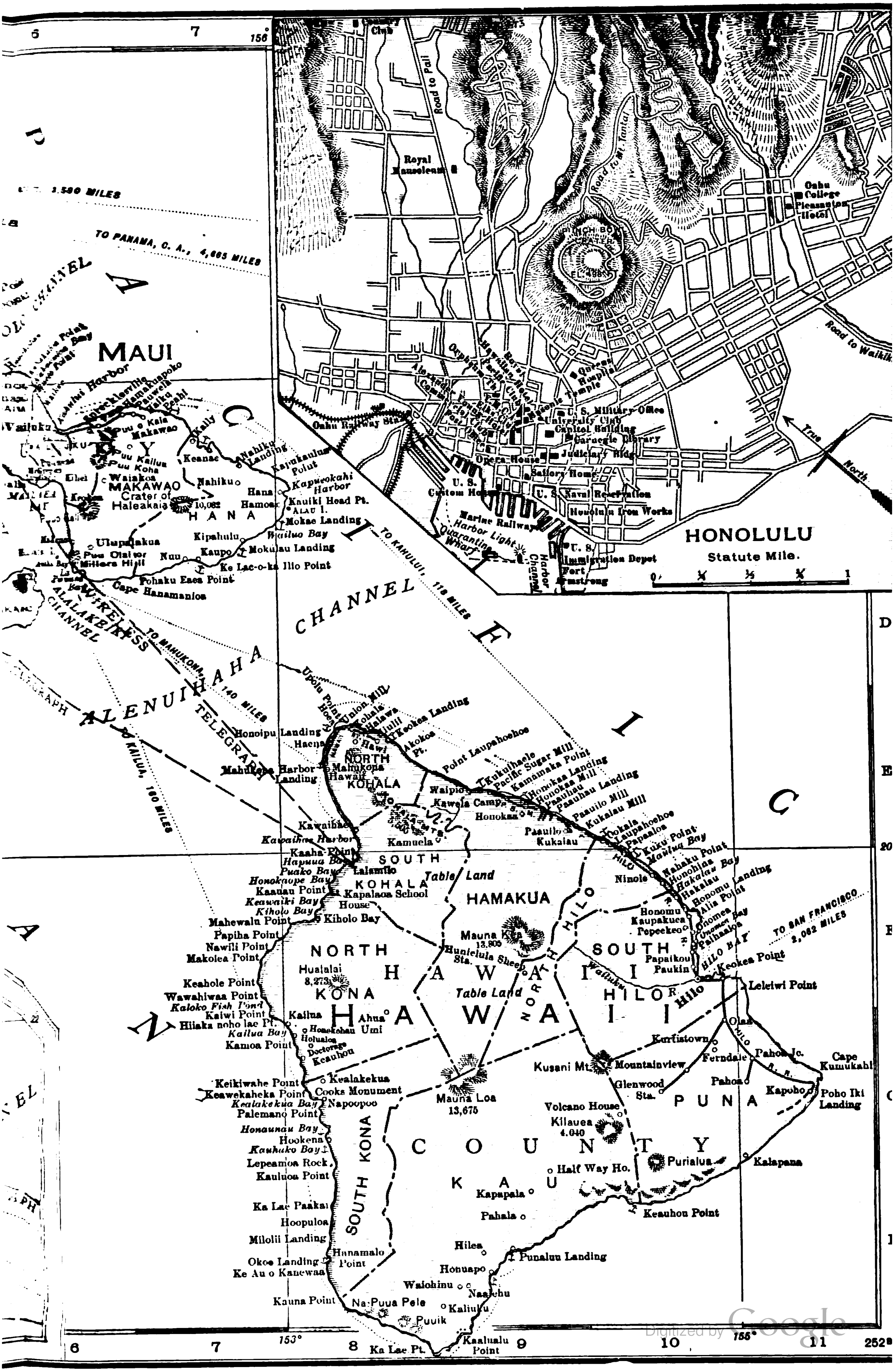


WESTERN ISLANDS OF HAWAII

ON SAME SCALE AS MAIN MAP


HONOLULU
Statute Mile.
0 ¼ ½ ¾ 1
Royal Mausoleum
Country Club
Road to Pali
Road to Mt. Tantalus
Punch Bowl
El. 498
Oahu College
Pleasanton Hotel
Road to Waikiki
True North
Queens Hospital
Masonic Temple
U. S. Military Office
University Club
Capitol Building
Carnegie Library
Judiciary Bldg.
Opera House
Sailors Home
Oahu Railway Sta.
U. S. Custom House
U. S. Naval Reservation
Honolulu Iron Works
Marine Railway
Harbor Light
Quarantine Wharf
Harbor Channel
U. S. Immigration Depot
Fort Armstrong
MAUI
Kahului Harbor
Spreckelsville
Hamakuapoko
Paia
Wailuku
Makawao
Kula
Puu Kailua
Puu Koha
Waiakoa
MAKAWAO
Crater of Haleakala
10,032
HANA
Keanae
Nahiku Landing
Nahiku
Kapukaulua Point
Kapueokahi Harbor
Hana
Hamoa
Knuiki Head Pt.
Alau I.
Mokae Landing
Kipahulu
Wailua Bay
Kaupo
Mokulau Landing
Nuu
Ulupalakua
Puu Olai
Millers Hill
Ke Lae-o-ka Ilio Point
Pohaku Eaea Point
Cape Hanamanioa
ALALAKEIKI CHANNEL
3,580 MILES
TO PANAMA, C. A., 4,665 MILES
TO KAHULUI, 118 MILES
TO MAHUKONA, 140 MILES
TO KAILUA, 160 MILES
WIRELESS TELEGRAPH
ALENUIHAHA CHANNEL
PACIFIC
Upolu Point
Union Mill
Kohala
Halawa
Niulii
Keokea Landing
Akokoa Pt.
Honoipu Landing
Hawi
NORTH KOHALA
Mahukona Harbor Landing
Point Laupahoehoe
Kukuihaele
Pacific Sugar Mill
Kaumana Point
Honokaa Landing
Honokaa Mill
Paauhau
Paauhau Landing
Paauilo Mill
Kukaiau Mill
Waipio
Kawela Camp
Honokaa
Paauilo
Kukaiau
Kawaihae
Kawaihae Harbor
Kamuela
Ookala
Laupahoehoe
Papaaloa
Kuku Point
Maulua Bay
Nahaku Point
Honohina
Hakalau Bay
Honomu Landing
Alia Point
Onomea Bay
Paihaalua
Kaaha Point
Hapuna Bay
Puako Bay
Lalamilo
SOUTH KOHALA
Table Land
HAMAKUA
Honokaope Bay
Kaauau Point
Keawaiki Bay
Kiholo Bay
Kapalaoa School
Mahewalu Point
Papiha Point
Nawili Point
Makolea Point
Mauna Kea
13,805
Huuelula Sheep Sta.
NORTH HILO
Ninole
Honomu
Kaupakuea
Pepeekeo
Papaikou
Paukaa
SOUTH HILO
HILO BAY
Keokea Point
TO SAN FRANCISCO 2,062 MILES
Hilo
Wailuku
Leleiwi Point
NORTH KONA
Hualalai
8,273
HAWAII
Table Land
Keahole Point
Wawahiwaa Point
Kaloko Fish Pond
Kaiwi Point
Hiiaka noho lae Pt.
Kailua
Kailua Bay
Ahua Umi
Honokohau
Holualoa
Doctorage
Keauhou
Kamoa Point
Olaa
Kurtistown
Ferndale
Pahoa Jc.
Cape Kumukahi
Kusani Mt.
Mountainview
Glenwood Sta.
Pahoa
Kapoho
Poho Iki Landing
PUNA
Keikiwahe Point
Keawekaheka Point
Kealakekua
Cooks Monument
Kealakekua Bay
Napoopoo
Palemano Point
Honaunau Bay
Hookena
Kauhako Bay
Lepeamoa Rock
Kauluoa Point
Mauna Loa
13,675
Volcano House
Kilauea
4,040
COUNTY
Purialua
Kalapana
Half Way Ho.
KAU
Kapapala
Pahala
Keauhou Point
SOUTH KONA
Ka Lae Paakai
Hoopuloa
Milolii Landing
Okoe Landing
Ke Au o Kanewaa
Hanamalo Point
Hilea
Punaluu Landing
Honuapo
Waiohinu
Naalehu
Kaliuku
Kauna Point
Na Puua Pele
Puuik
Kaalualu Point
Ka Lae Pt.
6
7
156°
153°
8
9
10
155°
11
D
E
20

Population.— The census of 1910 divides the population as follows: Hawaiians, 26,099; Part-Hawaiians, 12,485; Portuguese, 22,294; Americans and other Caucasians, 14,684; Chinese, 21,698; Japanese, 79,663; other foreigners (Spanish, Filipinos, etc.), 14,986; total, 191,909. Of the islands, Hawaii had 55,382; Oahu (including Honolulu, about 50,000), 82,028; Kauai and Niihau, 23,952; Kahoolawe, Lanai, Maui and Molokai, 29,762. Estimated population on 1 July 1915, 322,856.

Government.— The new territorial government was inauguarated at Honolulu 14 June 1900, and the first territorial legislature began its sessions at Honolulu 20 Feb. 1901. The legislature is composed of two houses — the senate of 15 members, holding office four years; and the house of representatives of 30 members, holding office two years. The legislature meets biennially, and sessions are limited to 60 days.

The executive power is lodged in a governor, a secretary, both appointed by the President, and holding office four years, and the following officials appointed by the governor, by and with the consent of the senate of Hawaii: an attorney-general, treasurer, commissioner of public lands, commissioner of agriculture and forestry, superintendent of public works, superintendent of public instruction, auditor and deputy surveyor, high sheriff, and members of the boards of health, public instruction, prison inspectors, etc. They hold office for four years, and must be citizens of Hawaii.

The judiciary of the Territory is composed of the Supreme Court with three judges, the Circuit Court and such inferior courts as the legislature may establish. The judges are appointed by the President of the United States. The Territory is a Federal judicial district, with a district judge, district attorney and marshal, all appointed by the President. The district judge has all the powers of a circuit judge.

The Territory is represented in Congress by a delegate, who is elected biennially by the people.

History.—According to documents in the Spanish archives, the islands were discovered in 1555 by Juan Gaetano, who named Hawaii "La Mesa." They were rediscovered by Capt. James Cook in 1778, and named the Sandwich Islands; in 1792 Captain Vancouver visited the islands, and introduced the first cattle and sheep. Kamehameha I, a chief of northern Hawaii, after nine years of war, became master of the whole island in 1791. In 1795 he conquered Maui and Oahu, the decisive battle being fought in Nuuanu Valley back of Honolulu. Having united the group under one strong government, he died 8 May 1819. His son, Kamehameha II, abolished the ancient tabu system in the following September. The first American missionaries arrived at Kailua, Hawaii, 4 April 1820, and met with remarkable success. The first Catholic missionaries arrived 7 July 1827. In the same year the first written laws were printed. The first constitution was proclaimed 8 Oct. 1840. On 25 Feb. 1843, the native government was compelled by Lord Paulet to make a provisional cession to Great Britain, but its independence was restored 31 July of the same year by Admiral Thomas. The feudal tenure of land was abolished in 1848, and a liberal constitution was adopted in 1852. The Kamehameha dynasty ended with the death of Kamehameha V, 11 Dec. 1872. David Kalakaua was elected by the legislature 12 Feb. 1874. In 1876 a reciprocity treaty was ratified with the United States, which assured prosperity to the islands. The king, however, labored to build up a reactionary party, and to restore autocratic government, until he was compelled by the civilized element to sign a revision of the constitution, which limited his powers, in 1887. A Royalist insurrection was put down in 1889. His sister, Liliuokalani, succeeded him in 1891, and in January 1893 undertook to abrogate the constitution, and establish an absolute monarchy. Upon this the constitutional party dethroned her, and established a provisional government. During the following year the republic of Hawaii was organized with S. B. Dole as President. An annexation treaty was negotiated with President Harrison, which was withdrawn by President Cleveland in April 1893, but brought up again on the accession of President McKinley. After long delays, Hawaii was admitted into the Union by a joint resolution passed 7 July 1898. It was finally organized as a Territory 14 June 1900, with S. B. Dole as governor, who was succeeded by Geo. R. Carter 23 Nov. 1903, by Walter F. Frear in 1907 and by L. E. Pinkham in 1913. Consult Blackman, W. F., 'The Making of Hawaii' (New York 1899); Boyce, W. D., 'The Hawaiian Islands,' etc. (Chicago 1914); Dibble, S., 'A History of the Sandwich Islands' (Honolulu 1909); Gerould, K. F., 'Hawaii: Scenes and Impressions'; Goodrich, J. K., 'The Coming Hawaii' (Chicago 1914); United States Statutes: 'Bills and Acts Relating to Hawaii' (Washington 1900).

W. D. ALEXANDER,
Formerly Surveyor-General Hawaiian Islands.

HAWAIIAN ISLANDS, Diplomatic Relations of the United States with. Immediately following the close of the Revolution, American vessels engaged in the Northwest trade began to stop at the Sandwich Islands, which had been discovered by Captain Cook in 1778. In 1791 Capt. Joseph Ingraham, the mate of the *Columbia*, returning from a trip around the world via Nootka and Canton, brought with him a native Crown Prince Opye whose visit to New England was the beginning of American friendship with Hawaii. In September of the same year, he re-embarked for the Pacific on the *Hope*, taking with him Opye who, after aiding in the discovery of the Marquesis group, was returned to his own island home. The Sandwich Islands became the principal place of resort for American trading vessels in the Pacific. In 1811, they were visited by John Jacob Astor who was seeking to engage supplies and men to aid in the fur trade on the Northwest coast where he founded Astoria in 1812. In 1814 they were visited by Lieutenant Gamble whom Captain Porter had left in command of Madison Island in the Marquesis group after its occupation in the name of the United States in 1813.

In 1820, American influence which was already considerable in the islands was increased by the arrival of missionaries from Boston to begin religious and humanitarian work. At the same time the importance of the islands was recognized by the American government in the appointment (by President Monroe) of John C. Jones as agent there for commerce and seamen.

By 1825 the American government, as a result of steadily increasing American interest, recognized the need of the occasional presence of a public force at the islands to prevent desertions, mutinies and other difficulties, and began to send naval vessels which had already been doing Pacific duty along the west coast of South America during the period of the Spanish-American revolts. In 1826, Capt. Thomas Catsby Jones, ordered to the Hawaiian Islands to protect commerce, to relieve the islands of seamen who had improperly deserted from whalers, to arrange to prevent future desertions and to secure debts due American citizens, negotiated a treaty by which the king agreed to permit trade, to aid wrecked vessels, to assist in preventing desertions, and in time of war to protect American ships and citizens in the islands against all enemies. This treaty, though never ratified, was observed as a tacit understanding. Unfortunately, however, trade relations and other conditions were still unsatisfactory, possibly partly as a result of the disagreement between foreign merchants and the missionaries. Captain Finch, who was sent in the United States ship *Vincennes* in 1829 to improve relations in the Pacific, saw at Oahu many indications of irregularities in commerce, severity to crews and bad effects of desertion. While assuring the king that the United States desired to preserve his sovereign right and to send war vessels for protection only where native governments failed to protect, he advised him to prevent secretion of deserters, to liquidate his debts, to retire from competition in the tavern business, to learn English and to spend his time more usefully. At the same time Consul Jones, referring to the growing importance of the islands, and to the increasing American trade, recommended semi-annual visits of American war vessels to reduce desertions and mutinies and to punish the guilty.

Other sources of dispute arose, including the refusal of the king to allow foreigners to transfer real estate. On these subjects Commodore E. P. Kennedy of the United States ship *Peacock* opened negotiations in 1836 but failed to obtain an agreement.

In 1832, J. N. Reynolds, who sailed with the Potomac punitive expedition to the coast of Sumatra and returned via Oahu, reported that crews of whalers, after attempts at mutiny or desertion, became outlaws on the shore, and as a means of controlling the causes of disorder, he recommended in addition to regular visits of war vessels an increase in the number of consuls. In 1834, he and J. Q. Adams also revived and stimulated the project for explorations in the Pacific, proposed for the South Seas as early as 1812 and finally realized in the Wilkes expedition of 1839–43 which stopped twice at Hawaii.

Meantime through the introduction of French Catholic priests in 1826, and their reintroduction in 1839, after banishment in 1831, French influence had increased. In 1842, induced by the arrival of a French vessel with new demands, the king invited the United States, England and France to negotiate new treaties for the guarantee of the independence and neutrality of the island. The American government, seeking no exclusive control or advantage, and desiring only that American rights should be respected and guarded, and also opposing interference by foreign powers, advised the Hawaiian commissioners to begin the diplomatic negotiations in England. In 1843, coincident with American renewal of negotiations for acquisition of Mexican territory reaching to the Pacific, occupation of the islands by a British naval commander (promptly disavowed by the English government) induced the American government to contemplate interference to prevent the conquest of Hawaii by a great European power, and to submit a calm expression of disapproval which doubtless influenced England and France to recognize Hawaiian independence and later to enter into a joint declaration (1845) agreeing never to take possession even under a protectorate.

Feeling the need of closer relations, the American government also began the appointment of diplomatic officials; and in December 1849, doubtless influenced by the acquisition of California, concluded a treaty of friendship, commerce, navigation and extradition.

Meantime French and English as well as American diplomatic relations had been unsatisfactory. After a French naval vessel resorted to force in 1849 to support the demands of the French consul for reparation (an action later disavowed by the French government), Secretary Clayton notified France that the United States, because of its relations with the islands, could never with indifference allow them to pass under the dominion or exclusive control of any other power.

In 1851, when the Hawaiian government, apprehensive of French designs, adopted a provisional cession of the islands to the United States, the American government through Secretary Webster declined to accept annexation, still advocating independence — at least until some pressing necessity might give the subject a new aspect or increased importance. However, it instructed the Navy Department to keep the Pacific armament in a position requisite for the safety of the Hawaiian government. Suggestions of annexation met with more favor two years later. In September 1853, Secretary Marcy issued official instructions that the United States would not allow other powers to exact special privileges or to establish a protectorate over the island. Later in the same year, while hoping to obtain Lower California by negotiations and stating that conditions in the islands and their connection with American industries in which American interests were paramount made American control appear inevitable, he sounded the French government on its policy or views in regard to the matter. In 1854, he authorized, in case of emergency, negotiations for a complete transfer of the islands to the United States as a territorial possession; and the Hawaiian king, in the face of warnings from the British and French consuls, agreed to a draft treaty providing for admission of the islands as a State of the American Union, but died while negotiations for the final execution of the treaty were still pending.

American influence, kept alive through the channels of industry, was especially increased by interest in the rise of the sugar industry which at the close of the Civil War became the basis of agitation for a treaty of reciprocity. In 1867, such a treaty, more liberal than that of 1855, and regarded as a means of making American influence dominant, and also in line with the policy of future annexation, was negotiated by written invitation of the Hawaiian government but after delayed action was rejected by the American Senate in June 1870.

Meantime, in July 1867, Secretary Seward, indicating that lawful peaceful annexation was more desirable than reciprocity, had authorized the American Minister to sound the Hawaiian government on the subject and confidentially to receive overtures; but in 1868, seeing the American mind absorbed with domestic questions, he prudently avoided giving further encouragement to Hawaiian-American annexation. In 1871, and in 1873, the American government was again asked to accept the opportunity to annex the islands, and in 1873 Secretary Fish authorized inquiries as to the views of the Hawaiian government concerning the policy and conditions of annexation.

In 1875, to meet the wishes of the California sugar interests, the American government negotiated a favorable reciprocity treaty which granted to the United States certain exclusive privileges. The principle of this treaty, representing a policy of commercial assimilation and virtually establishing an American protectorate, was renewed in 1884 by a treaty (ratified in 1887) giving the United States exclusive right to enter Pearl Harbor and to establish a coaling station there. Secretary Bayard declined the British proposal for a tripartite Anglo-American-German guarantee of the neutrality of the islands.

After various disturbances and apprehended crises, resulting in an increasing annexation sentiment, in 1893 following the deposition of Queen Liliuokalani, a newly-established provisional government, aided by the American minister, applied for annexation, and its commissioners negotiated at Washington a treaty of annexation which was submitted to the Senate by President Harrison but later withdrawn by President Cleveland pending an investigation of the Hawaiian situation.

The refusal of the Cleveland administration to accept the results of the revolution of 1893 only delayed the inevitable incorporation of Hawaii, which had been rendered more necessary by the recent occupation of other islands of the Pacific by Germany and other European powers. The new mid-ocean republic of 1894 favored annexation, and in 1897 negotiated a treaty of annexation which was pending in the Senate at the beginning of the Spanish-American War. Soon thereafter, friends of annexation introduced a joint resolution of annexation, which passed both houses by large majorities and was signed 7 July 1898, vesting the government in the President until Congress should pass suitable legislation. Formal cession was made on 12 Aug. 1898. An act of 30 April 1900 fully organized the Territory and extended provisions of the Constitution and laws of the United States and conferred American citizenship upon all citizens, including Chinese born or naturalized in the island.

Bibliography.— Allen, A. H., 'Relations between the United States and the Hawaiian Islands, 1820–93' (Sen. Exec. Doc. 1893); Callahan, J. M., 'America in the Pacific and the Far East' (1901); Foster, J. W., 'American Diplomacy in the Orient' (1903); Moore, J. B., 'Digest of International Law' (1906).

James M. Callahan,
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HAWES' SHOP, Cavalry Engagement Near. General Grant had crossed to the south bank of the North Anna, in Virginia, and finding General Lee too strongly posted to be attacked, and his own army in a false and critical position, he withdrew, on the night of 26 May 1864, to the north bank, and moved down the north bank of the Pamunkey to turn Lee's right. Torbert's and Gregg's divisions of cavalry, under Sheridan, together with the Sixth corps led the advance. Torbert crossed the Pamunkey at Hanover Ferry on the 27th, after considerable skirmishing in which he took about 60 prisoners, and the two cavalry divisions, supported by Russell's division of infantry, pushed on to Hanover Town and bivouacked for the night. On the morning of the 28th Sheridan was directed to make a demonstration and discover the enemy's position. Gregg's division, advancing on the Mechanicsville road, encountered the two cavalry divisions of Wade Hampton and Fitzhugh Lee and Butler's South Carolina cavalry brigade about a mile beyond Hawes' Shop. The Confederate cavalry was dismounted and had thrown up a barricade of rails covering the road. Gregg attacked, and there ensued one of the most severe cavalry engagements of the war, which continued several hours, neither side yielding ground. Finally late in the day, Custer's brigade of Torbert's division came up, dismounted, took position in the centre of Gregg's line, formed in close column of attack, the whole line charged and, after a hard struggle at close quarters, the Confederates were driven from the position and retreated upon their infantry at the Totopotomoy. Gregg's loss was 256 killed and wounded; the entire Union loss was 44 killed and 306 wounded. The Confederate loss is not known. Consult 'Official Records' (Vol. XXXVI); Humphreys, 'The Virginian Campaign of 1864–65'; The Century Company's 'Battles and Leaders of the Civil War' (Vol. IV).

HAWESVILLE, hâz'vĭl, Ky., city, county-seat of Hancock County, on the Ohio River, and on the Louisville, Henderson and Saint Louis Railroad, about 65 miles above Evansville, Ind., and 80 miles west by south from Louisville. It is situated in an agricultural and coal-mining region. Its chief manufactures are flour, lumber, hubs and furniture. It has a number of tobacco factories or stemmeries, and its trade is chiefly in tobacco, coal, articles of home manufacture and agricultural products. Pop. 1,002.

HAWFINCH, one of the largest of European finches (*Coccothraustes vulgaris*), so called in England from the belief that it subsisted principally on the fruit of the hawthorn. It resembles the chaffinch in color, but is distinguished by its enormous beak and larger size. It feeds on all kinds of berries.

HAWK, any diurnal bird of prey not an eagle or a vulture. As the general characteristics of this group have been given under FALCONIDÆ, and the use of falcons in sport under FALCONRY, the general term "hawk" will be treated from the point of view of economic relations. Hawks are found in all parts of the world and number about 450 species. All are of moderate size, and some Old World species are no larger than a robin. All seek their prey by daylight and are endowed with great swiftness of flight, immense clutching power in their talons, hooked and toothed beaks adapted to cutting and tearing flesh and remarkable keenness of vision. (See EYESIGHT OF ANIMALS). All are exclusively carnivorous and rarely taste anything they have not themselves killed. Hawks show great boldness in attacking quarry, seeking it as a rule by patiently watching from an elevated perch until a prospective victim appears, then pouncing on it; but some search for food in suitable places, flying to and fro in the hope of catching sight of a moving animal, or of scaring one from its hiding-place. When it has been caught by a rapid swoop it is borne away in the talons to be eaten at leisure, or carried to the nestlings.

Most hawks are dressed plainly in browns and whites, with darker markings, although some have bright feathers in their plumage, but none has in either sex ornamental crests or plumes. The sexes always differ in size, the female being the larger, often conspicuously so; and the plumage of the young varies much from that of the adults. They nest in forest trees, on rock-ledges or on the ground, and usually lay four or five whitish eggs, heavily blotched with brown, red and lavender. A few, as, for example, the duck-hawk (peregrine), and the fish-hawk (q.v.) (osprey), repair and use the same nest many years in succession, but most species get a new mate and make a new nest every season. The voice of most hawks consists of loud screams, and none sings in any proper sense of the word. Hawks, as a rule, are solitary birds, but in the annual migrations (which affect most species) they sometimes travel in considerable flocks. Few are tameable, yet the osprey and the sparrow-hawk are inclined to accept artificial nesting accommodations near houses when made welcome.

North America has hawks of all kinds, including about 34 species north of Mexico, representing the families *Falconidæ*, *Buteonidæ* and *Pandionidæ*. Taking these in systematic order and passing by the southern kites elsewhere described (see KITE), we come to the three species that may properly be termed "hen-hawks," since to these three alone may commonly be attributed the loss of poultry suffered on farms and in villages.

True Hen-Hawks.—All are small, fierce and powerful, addicted to the capture of birds, wild and tame, although many wild mice and other small mammals, and a few frogs, lizards and insects, are also eaten. The first of them is the sharpshin (*Accipiter velox*), a summer resident of all North and Central America, and retiring in winter only to the Southern States. It is known as bird-hawk, chicken-hawk, bullet-hawk and sparrow-hawk. Birds constitute nine-tenths of its fare, speaking generally; and it is able to strike down and carry off fully-grown chickens, quails or grouse, as well as small birds, whose only safety is to make a quick dive into some thick bush. The sharpshin may be known by its small size (length 11 to 13.5 inches, wing-spread about 15 inches); long tail, square at the end; slender legs and feet and very long toes. In color it is uniformly bluish-gray or slate-colored, dark on the crown; under parts white, heavily barred with reddish-brown, except the throat, which is narrowly streaked; wing-quills blackish; tail with five blackish crossbars and narrowly tipped with white; feet yellow. Immature young, brownish above, streaked white below.

Cooper's hawk, or the blue darter (*Accipiter cooperi*), is closely similar in color and proportions, but is nearly a third larger, has stouter feet, and the tail is rounded, not square, at the end, and is indistinctly barred. This species does not go far north. but from southern Canada southward is one of the most abundant of American hawks, and like the sharpshin it retreats in winter only from the more northern border of its range. It is known to farmers and sportsmen as chicken-hawk, quail-hawk, swift-hawk and darter.

The third bird-killer is the goshawk (*Astur atricapillus*), which inhabits Canada and northern Europe, where it has always been one of the favorites of falconers. It is much larger than the others, measuring 22 to 24 inches from bill-tip to tail-end; and when adult is bluish above, crown darker, has a broad whitish stripe over the eye, the whole under surface finely marked with gray and white, and the long tail crossed by four narrow dark-brown bars. Immature young are dusky brown, mottled with reddish and buff. This bold northern marauder is variously called blue hen-hawk, blue darter, dove-hawk, etc., but it is rarely seen in the United States except in midwinter.

The three falcons described above are the true "hen-hawks" and are unprotected by law. They, and they alone, are responsible for virtually all the loss of poultry and game-birds. The description of the methods of the sharpshin given by W. B. Barrows in his admirable 'Birds of Michigan' (Lansing 1912) will answer for those of the others:

> This is the common "chicken-hawk" of the farmers, and probably is responsible for most of the loss of small chickens. The bird has a habit of dashing suddenly among the poultry, picking up a small chicken in its claws, and carrying it away so quickly that it is commonly impossible to kill the robber. It is very likely to return the same day or the next, and to repeat its visits indefinitely until killed. Unlike the buzzard-hawks, the Cooper's and sharpshin seldom wheel aloft on the lookout for food, but fly swiftly and silently from place to place, flapping the wings rapidly for a few seconds and then gliding noiselessly, always alert and watchful, and ever ready to drop like an arrow on some unsuspecting victim.

Two other small falcons, the pigeon-hawk and the sparrow-hawk, catch small birds when their young are in the nest, and need tender food, but the former is so uncommon, and the latter so little addicted to chicken-stealing, that they need not be feared. Both live principally on insects and mice, the beautiful little sparrow-hawk being particularly helpful by its constant pursuit of grasshoppers and crickets. The duck-hawk, or peregrine, is an enemy to game-birds and waterfowl, but is now rare and extremely shy of humanity.

Beneficial Hawks.— The large hawks so often seen in the country sailing above the fields or perched on some tree at the edges of the woods belong to the genera *Buteo* and *Archibuteo*, and are known as "buzzard-hawks." They do not possess the knightly qualities we admire in the falcons, but unfortunately have constantly to answer for the sins of those dashing gentry. Familiar species in the Eastern States and provinces are the red-tailed, the red-shouldered, the broad-winged and the rough-legged buzzard-hawks. The roughleg, so called because feathered down to the toes, is a northern species, visiting the United States only in winter, when it ranges the fields in search of mice; it is entirely harmless and should be rigidly protected by farmers. Another species deserving of special mention because it is everywhere numerous and a valuable ally of the hard-working agriculturist is the marsh-hawk (*Circus cyaneus*). It is to be seen only in low, open places where, flying slowly and low, and nesting on the ground, it gets great numbers of mice, frogs and grasshoppers, but no birds. No hawk is more harmless or serviceable, especially as a destroyer of field-mice, that worst pest of the farmer, and it should never be killed. It is easily recognized by its low flight, bluish tint and conspicuous white rump.

Most of these big, slow hawks range across the continent in western varieties; and in addition several species belong exclusively to the plains and mountains of the West, while the southwestern border of the United States is entered by several subtropical species, some of which range in summer far up the Californian coast. While indignant and undiscriminating farmers and poultrymen are likely to call all or any of these "hen-hawks," the mischief of which they are guilty in the nesting-season is so small that it is negligible in comparison with the benefit they render all the year round by their destruction of rabbits, ground-squirrels, gophers, field-mice, grasshoppers, crickets and other injurious creatures that cost the farmer and gardener enormous aggregate loss. No poultry will be sacrificed, even to the bold sharpshin and blue darters when it is housed or brush-sheltered and cared for as good poultry ought to be; and it is the height of folly to shoot hawks indiscriminately. Consult Fisher, 'Hawks and Owls of the United States in their Relation to Agriculture' (Washington 1893); Forbush, 'Useful Birds and their Protection' (Boston 1907); Weed and Dearborn, 'Birds in their Relation to Man' (Philadelphia 1903); and general works mentioned under BIRDS.

ERNEST INGERSOLL.

HAWK-MOTHS, a family of large moths forming the family *Sphingidæ*. They have stout bodies, large heads with prominent eyes, and thick spindle-shaped antennæ, ending in a hook. The fore-wings are long, narrow, more or less pointed, and always much longer than the hind-wings. They are insects of rapid flight and dart about in the twilight; some species also during the day. Their caterpillars are hairless, smooth, often green, with transverse stripes on the sides and nearly always a horn on the back of the second last segment, and always have 10 pro-legs. They are leaf-eaters and often greatly destructive to cultivated plants, the tomato-worm being a prominent example. They change to pupæ either on the surface of the ground or in a cell underground, but make no cocoon. Some of the South American species resemble humming-birds so closely, especially when poising before a flower on whirring wings and sucking its nectar, that they can hardly be distinguished, and popular belief asserts that the one is transmutable into the other. A great number of forms exist in all parts of the world, the United States having about 100 species. All are plainly dressed in grays and browns, and one of the most remarkable is the death's-head (q.v.).

HAWKBIT, a genus (*Leontodon*) of plants of the family *Cichoriaceæ*, closely related to the dandelion, from which they differ in having feathery pappus. The name is due to the peculiar shape of the lacerations of the leaves. Numerous species are natives of Europe and Asia and a few have become naturalized in eastern North America.

HAWKE, Edward, LORD, English sailor: b. London, 1705; d. Sunbury-on-Thames, 17 Oct. 1781. Early in 1720 Hawke entered the navy and was appointed in 1733 to the command of the *Wolf*. Being promoted to the command of a squadron in 1747 he totally defeated the French fleet off Belle Isle. In 1759 he was sent in pursuit of the Brest fleet, which he came up with in Quiberon Bay and signally defeated (20 November). This is regarded as the naval counterpart of the battle of the Plains of Abraham, by which the fate of the New World was decided. He now received a pension of £2,000, and in 1768 became admiral of Great Britain and commander-in-chief of the fleet. From 1766 to 1771 he was First Lord of the Admiralty. In 1776 he was advanced to a seat in the House of Lords by the style of Baron Hawke of Towton. Consult the 'Life' by Burrows; and Mahan, 'Types of Naval Officers' (1901).

HAWKESBURY, hâks'bĕr-ĭ, Canada, village in Prescott County, Ontario, on the Ottawa River, half-way between Montreal and Ottawa, on the Grand Trunk and Canadian Northern railways. It has ferry communication with Grenville, across the river. Its chief industrial establishments are paper and pulp mills, flour mills and large saw and planing mills. The largest sulphite paper mill in the British Empire is located here. It has an extensive lumber trade. Pop. 4,400.

HAWKING. See FALCONRY.

HAWKINS, Anthony Hope, English novelist, known by the pen-name "ANTHONY HOPE": b. London, 9 Feb. 1863. He was educated at Balliol College, Oxford, was admitted to the bar of the Middle Temple in 1887 and practised until 1894 on the London and Midland circuit. He contested South Bucks as a Liberal in 1892, but unsuccessfully. In 1894 he achieved a striking literary success with his 'Prisoner of Zenda,' the scene of which is laid in an imaginary independent state of South Germany. Other books of his are 'The Dolly Dialogues' (1894), cited as models of keen if somewhat shallow repartee; 'The Chronicles of Count Antonio' (1895); 'Rupert of Hentzau' (1898); 'The Intrusions of Peggy' (1902); 'Double Harness'; 'A Servant of the Public' 'Tales of Two People' (1907); 'The Great Miss

Driver' (1908); 'Second String' (1910); 'Miss Maxon Protests,' 'A Young Man's Year' (1915).

HAWKINS, Hamilton Smith, American military officer: b. South Carolina, 1834; d. Glen Springs, N. Y., 28 March 1910. He was graduated at the United States Military Academy in 1855. He entered the army in 1861, was made captain in the Sixth Infantry in 1863 and brevetted major in October 1865. In 1888 he became commandant at West Point, and in 1894 was promoted colonel. When war was declared against Spain he went to the front as a brigadier-general of volunteers. He led the charge at San Juan, Cuba, 2 July 1898 and was made major-general of volunteers 8 July 1898 and later was made brigadier-general. He was retired 1904.

HAWKINSVILLE, Ga., village, county-seat of Pulaski County on the Ocmulgee River, at the head of navigation, and on the Southern, the Hawkinsville and Florida Southern and other railroads, about 48 miles south of Macon. It is situated in a fertile agricultural region. It has a cotton factory, cotton compresses, cotton gins, cottonseed-oil mills, barrel factories, carriage and wagon works, fertilizer factory, hardwood mill, a brickyard, etc. Its trade is chiefly in cotton, lumber, naval stores, fruits and vegetables. The electric-light plant and the waterworks are municipally owned. Pop. 3,420.

HAWKSBEARD, perennial composite plants allied to hawkweed, but of the genus *Crepis,* about 250 species of which are known in the northern hemisphere. Several are European weeds which have become naturalized in the United States, and there are several native species. The flowers are dandelion-like and yellow or orange.

HAWKSBILL, a great marine turtle (*Chelone imbricata*) allied to the green turtle, but which has the plates of the shell overlapping; and these plates form the tortoise-shell (q.v.) of commerce. The flesh is not good for eating, but the eggs are good. The animal inhabits the Indian Ocean, the Pacific and the warmer parts of the Atlantic. This is one of the sea-turtles called «caret,» but that term belongs more properly to the loggerhead. See TURTLE.

HAWKWEED, or RATTLESNAKE WEED, a genus (*Hieracium*) of plants of the family *Cichoriaceæ,* with mostly low hairy stems and yellow or orange heads of flowers. One species, the European orange hawkweed (*H. aurantiacum*), is frequently cultivated for the sake of its fine orange flowers. The name «hawkweed» in English, and various similar names in use among the peasants of continental Europe, are based on an ancient belief that birds of prey used the juice of the species to strengthen their vision. Several species grow in the United States, where they have been called «rattlesnake weeds» from a popular belief that they were of value in curing the poison of snakes.

HAWKWOOD, SIR John de, English soldier: b. Hedingham Sibil, Essex; d. Florence, Italy, 17 March 1394. He was styled by Hallam the first distinguished commander who had appeared in Europe since the destruction of the Roman Empire. It is said that he fought at Crécy and Poitiers, and for his bravery was knighted by Edward III. However that may be, in 1359 he was the leader of a troop of free lances preying upon France and northern Italy. With this band, the «White Company,» he served the Marquis of Montserrat, later the republic of Pisa, and still later Florence, upon whose side he oftenest fought in the civil disturbances of Italy. As commander-in-chief he directed the successful war against Milan (1390–92). He was pensioned by the Florentines and entombed with great ceremony in the Duomo.

HAWLEY, Gideon, American missionary to the Indians: b. Stratford, now Bridgeport, Conn., 11 Nov. 1727; d. Marshpee, Mass., 3 Oct. 1807. He was graduated at Yale College in 1749, and commenced his labors at Stockbridge in 1752, opening a school at that place, in which he instructed a number of Mohawk, Oneida and Tuscarora families. In 1754, under the patronage of Sir William Johnson, he began a mission among the Iroquois, or Six Nations, on the Susquehanna River; but in 1756 was obliged by the disturbances of the French war to leave that region, when he became a chaplain in the army marching against Crown Point. The campaign being over, he re-engaged in his missionary work at Marshpee, where he was installed as pastor in 1758, and there passed the remainder of his life in his benevolent labors.

HAWLEY, Joseph, American statesman: b. Northampton, Mass., 1723; d. 10 March 1788. He was graduated at Yale College, and followed the profession of law at Northampton, in which he rose to eminence. At the time of the disputes between Great Britain and America, he took a prominent part in advocating the cause of the colonies. «We must fight,» he wrote to the delegates of Massachusetts, «if we cannot otherwise rid ourselves of British taxation. The form of government enacted for us by the British parliament is evil against right, utterly intolerable to every man who has any idea or feeling of right or liberty.» He was several times elected a member of the council, but declined, preferring to enter the State legislature, of which he was a member 1764–66.

HAWLEY, Joseph Roswell, American politician and legislator: b. Stewartsville, N. C., 31 Oct. 1826; d. Washington, D. C., 17 March 1905. He was graduated at Hamilton College, Clinton, N. Y., 1847, and began the practice of law at Hartford, Conn., in 1850. The Republican party in Connecticut was organized in the office of the *Charter Oak,* of which he was the editor. He afterward became editor of the Hartford *Evening Post,* the new Republican paper. When the Civil War broke out he recruited the first company of volunteers raised in the State — Company A of the First Connecticut regiment — of which he took command. He saw service throughout the whole war and was mustered out in 1866 with the brevet rank of major-general. He was elected governor of Connecticut the same year. He was defeated for re-election in 1867, and again turned to journalism. He purchased the Hartford *Courant* and united it with the *Press,* and made it one of the most influential Republican newspapers in the country. He took a leading part in the councils of the Republican party. In

1872 he was elected to Congress; at the end of the term, 1879–81, was sent to the United States Senate, to which he was re-elected 1887, 1893 and 1899. He was president of the United States Centennial Committee 1873–76. Fourteen days before his death, he was placed on the retired list of the army with the rank of brigadier-general.

HAWORTH, hâ'wėrth, **Adrian Hardy**, English naturalist: b. Hull, 1767; d. Chelsea, 24 Aug. 1833. He was educated for the law, but did not practice, devoting his time to entomology and botany. He was the founder of the Entomological Society of London. The Hull Botanical Gardens were planned by him and laid out under his direction. His collections were large and important, and his works are still standard. He wrote ‘Observations on the Genus Mesembryanthemum’ (1794); ‘Prodromus Lepidopdtrorum Britannicorum’ (1802); and ‘Synopsis Plantarum Succulentarum’ (1812); and many minor papers.

HAWORTH, Joseph, American actor: b. Providence, R. I., 1855; d. 29 Aug. 1903. His first appearance was as a member of Ellsler's stock company at Cleveland, Ohio, and subsequently he supported Edwin Booth, Lawrence Barrett and John McCullough. From 1883 he toured for several years as a star in ‘The Bells,’ ‘The Leavenworth Case,’ ‘Hamlet,’ and other productions; in 1896–98 was Macbeth to Modjeska's Lady Macbeth, and later Storm in Caine's ‘Christian,’ Vinicius in Stange's adaptation of Sienkiewicz's ‘Quo Vadis,’ and Cassius in the Mansfield presentation of ‘Julius Cæsar.’

HAWSER, a manila or wire rope used in mooring or towing boats, etc., over four or three inches in circumference respectively. The name is now usually applied to all large ropes, though formerly it signified ropes «hawser-laid,» that is, with three «plain-laid,» three-stranded ropes laid up left-handed, now usually called a cable-laid rope.

HAWTHORN, or WHITE THORN (*Cratægus oxyacantha*), a small spiny European tree, rising sometimes to the height of 20 to 25 feet, much admired for the beauty of its foliage. The leaves are smooth, shining, more or less deeply lobed, and of a beautiful green color; the flowers are white, sometimes with a reddish tinge disposed in corymbs, and possess an agreeable perfume. The species of *Cratægus* are all shrubs or small trees, spiny, with red fruit resembling in miniature that of the apple, from which plant they are distinguished chiefly by their seeds, and are arranged with it in the family *Malaceæ*. In the last 25 years more than a thousand species have been described from North America, but the number of valid species is undoubtedly much lower. When young the hawthorn springs up rapidly, a shoot of a single year being sufficient for a walking-stick. It thus, if well pruned and kept down, quickly grows into a thick and intricately woven hedge.

HAWTHORNE, hâ'thôrn, **Julian**, American novelist and journalist, son of Nathaniel Hawthorne (q.v.): b. Boston, Mass., 22 June 1846. He was graduated from Harvard University in 1867 and afterward studied civil engineering in Dresden, but soon forsook this occupation for literature. His first successful story was ‘Bressant’ (1872), the forerunner of a long list of novels, of which may be particularized ‘Garth’ (1875); ‘Sebastian Strome’ (1884); ‘Archibald Malmaison’ (1884); ‘A Fool of Nature’ (1896). He has also published ‘Saxon Studies’ (1876); and ‘Nathaniel Hawthorne and His Wife’ (1885); ‘Confessions and Criticisms’ (1886); ‘American Literature’ (1891); ‘History of the United States’ (1899; 1912); ‘Hawthorne and His Circle’ (1903); ‘The Subterranean Brotherhood’ (1914), a record of his prison experiences in Atlanta. His best work suggests more than one element that distinguishes his father's stories. There is a psychologic accent, the touch of mystery, and the avoidance of the stock properties of romance. See MORTON, W. J.

HAWTHORNE, Nathaniel, American novelist: b. Salem, Mass., 4 July 1804; d. Plymouth, N. H., 19 May 1864. The founder of the family in America was William Hathorne (as the name was then spelled), a typical Puritan and a public man of importance. John, his son, was a judge, one of those presiding over the witchcraft trials. Of Joseph in the next generation little is said, but Daniel, next in descent, followed the sea and commanded a privateer in the Revolution, while his son Nathaniel, father of the romancer, was also a sea captain. This pure New England descent gave a personal character to Hawthorne's presentations of New England life; when he writes of the strictness of the early Puritans, of the forests haunted by Indians, of the magnificence of the provincial days, of men high in the opinion of their towns-people, of the reaching out to far lands and exotic splendors, he is expressing the stored-up experience of his race. His father died when Nathaniel was but four and the little family lived a secluded life with his mother. He was a handsome boy and quite devoted to reading, by an early accident which for a time prevented outdoor games. His first school was with Dr. Worcester, the lexicographer. In 1818 his mother moved to Raymond, Me., where her brother had bought land, and Hawthorne went to Bowdoin College. He entered college at the age of 17 in the same class with Longfellow. In the class above him was Franklin Pierce, afterward 12th President of the United States. On being graduated in 1825 Hawthorne determined upon literature as a profession, but his first efforts were without success. ‘Fanshawe’ was published anonymously in 1828, and shorter tales and sketches were without importance. Little need be said of these earlier years save to note that they were full of reading and observation. In 1836 he edited in Boston the *American Magazine for Useful and Entertaining Knowledge*, but gained little from it save an introduction to ‘The Token,’ in which his tales first came to be known. Returning to Salem he lived a very secluded life, seeing almost no one (rather a family trait), and devoted to his thoughts and imaginations. He was a strong and powerful man, of excellent health and, though silent, cheerful, and a delightful companion when he chose. But intellectually he was of a separated and individual type, having his own extravagances and powers and submitting to no companionship in influence. In 1837 appeared 'Twice Told Tales' in book form: in a preface written afterward Hawthorne says that he was at this time "the obscurest man of letters in America." Gradually he began to be more widely received. In 1839 he became engaged to Miss Sophia Peabody, but was not married for some years. In 1838 he was appointed to a place in the Boston custom house, but found that he could not easily save time enough for literature and was not very sorry when the change of administration put him out of office. In 1841 was founded the socialistic community at Brook Farm: it seemed to Hawthorne that here was a chance for a union of intellectual and physical work, whereby he might make a suitable home for his future wife. It failed to fulfil his expectations and Hawthorne withdrew from the experiment. In 1842 he was married and moved with his wife to the Old Manse at Concord just above the historic bridge. Here chiefly he wrote the 'Mosses of an Old Manse' (1846). In 1845 he published a second series of 'Twice Told Tales'; in this year also the family moved to Salem, where he had received the appointment of surveyor at the custom house. As before, official work was a hindrance to literature; not till 1849 when he lost his position could he work seriously. He used his new-found leisure in carrying out a theme that had been long in his mind and produced 'The Scarlet Letter' in 1850. This, the first of his longer novels, was received with enthusiasm and at once gave him a distinct place in literature. He now moved to Lenox, Mass., where he began on 'The House of Seven Gables,' which was published in 1851. He also wrote 'A Wonder-Book' here, which in its way has become as famous as his more important work. In December 1851 he moved to West Newton, and shortly to Concord again, this time to the Wayside. At Newton he wrote 'The Blithedale Romance.' Having settled himself at Concord in the summer of 1852, his first literary work was to write the life of his college friend, Franklin Pierce, just nominated for the Presidency. This done he turned to 'Tanglewood Tales,' a volume not unlike the 'Wonder-Book.' In 1853 he was named consul to Liverpool: at first he declined the position, but finally resolved to take this opportunity to see something of Europe. He spent four years in England, and then a year in Italy. As before, he could write nothing while an official, and resigned in 1857 to go to Rome, where he passed the winter, and to Florence, where he received suggestions and ideas which gave him stimulus for literary work. The summer of 1858 he passed at Redcar, in Yorkshire, where he wrote 'The Marble Faun.' In June 1860 he sailed for America, where he returned to the Wayside. For a time he did little literary work: in 1863 he published 'Our Old Home,' a series of sketches of English life, and planned a new novel, 'The Dolliver Romance,' also called 'Pansie.' But though he suffered from no disease his vitality seemed relaxed: some unfortunate accidents had a depressing effect, and in the midst of a carriage trip into the White Mountains with his old friend, Franklin Pierce, he died suddenly at Plymouth, N. H., early in the morning, 19 May 1864.

The works of Hawthorne consist of novels, short stories, tales for children, sketches of life and travel and some miscellaneous pieces of a biographical or descriptive character. Besides these there were published after his death extracts from his notebooks. Of his novels 'The Scarlet Letter' is a story of old New England: it has a powerful moral idea at bottom, but it is equally strong in its presentation of life and character in the early days of Massachusetts. 'House of the Seven Gables' presents New England life of a later date: there is more of careful analysis and presentation of character and more description of life and manners, but less moral intensity. 'The Blithedale Romance' is less strong: Hawthorne seems hardly to grasp his subject. It makes the third in what may be called a series of romances presenting the molding currents of New England life: the first showing the factors of religion and sin, the second the forces of hereditary good and evil, and the third giving a picture of intellectual and emotional ferment in a society which had come from very different beginnings. 'Septimius Felton,' finished in the main but not published by Hawthorne, is a fantastic story dealing with the idea of immortality. It was put aside by Hawthorne when he began to write 'The Dolliver Romance,' of which he completed only the first chapters. 'Dr. Grimshaw's Secret' (published in 1882) is also not entirely finished. These three books represent a purpose that Hawthorne never carried out. He had presented New England life, with which the life of himself and his ancestry was so indissolubly connected, in three characteristic phases. He had traced New England history to its source. He now looked back across the ocean to the England he had learned to know, and thought of a tale that should bridge the gulf between the Old World and the New. But the stories are all incomplete and should be read only by the student. The same thing may be said of 'Fanshawe,' which was published anonymously early in Hawthorne's life and later withdrawn from circulation. 'The Marble Faun' presents to us a conception of the Old World at its oldest point. It is Hawthorne's most elaborate work, and if every one were familiar with the scenes so discursively described, would probably be more generally considered his best. Like the other novels its motive is based on the problem of evil, but we have not precisely atonement nor retribution, as in his first two novels. The story is one of development, a transformation of the soul through the overcoming of evil. The four novels constitute the foundation of Hawthorne's literary fame and character, but the collections of short stories do much to develop and complete the structure. They are of various kinds, as follows: (1) Sketches of current life or of history, as 'Rills from the Town Pump,' 'The Village Uncle,' 'Main Street,' 'Old News.' These are chiefly descriptive and have little story; there are about 20 of them. (2) Stories of old New England, as ‘The Gray Champion,’ ‘The Gentle Boy,’ ‘Tales of the Province House.’ These stories are often illustrative of some idea and so might find place in the next set. (3) Stories based upon some idea, as ‘Ethan Brand,’ which presents the idea of the unpardonable sin; ‘The Minister's Black Veil,’ the idea of the separation of each soul from its fellows; ‘Young Goodman Brown,’ the power of doubt in good and evil. These are the most characteristic of Hawthorne's short stories; there are about a dozen of them. (4) Somewhat different are the allegories, as ‘The Great Stone Face,’ ‘Rappacini's Daughter,’ ‘The Great Carbuncle.’ Here the figures are not examples or types, but symbols, although in no story is the allegory consistent. (5) There are also purely fantastic developments of some idea, as ‘The New Adam and Eve,’ ‘The Christmas Banquet,’ ‘The Celestial Railroad.’ These differ from the others in that there is an almost logical development of some fancy, as in case of the first the idea of a perfectly natural pair being suddenly introduced to all the conventionalities of our civilization. There are perhaps 20 of these fantasies. Hawthorne's stories from classical mythology, the ‘Wonder-Book’ and ‘Tanglewood Tales,’ belong to a special class of books, those in which men of genius have retold stories of the past in forms suited to the present. The stories themselves are set in a piece of narrative and description which gives the atmosphere of the time of the writer, and the old legends are turned from stately myths not merely to children's stories, but to romantic fancies. Mr. Pringle in ‘Tanglewood Fireside’ comments on the idea: «Eustace,» he says to the young college student who had been telling the stories to the children, «pray let me advise you never more to meddle with a classical myth. Your imagination is altogether Gothic and will inevitably Gothicize everything that you touch. The effect is like bedaubing a marble statue with paint. This giant, now! How can you have ventured to thrust his huge disproportioned mass among the seemly outlines of Grecian fable?» «I described the giant as he appeared to me,» replied the student. «And, sir, if you would only bring your mind into such a relation to these fables as is necessary in order to remodel them, you would see at once that an old Greek has no more exclusive right to them than a modern Yankee has. They are the common property of the world and of all time» (‘Wonder-Book,’ p. 135). ‘Grandfather's Chair’ was also written primarily for children and gives narratives of New England history, joined together by a running comment and narrative from Grandfather, whose old chair had come to New England, not in the *Mayflower,* but with John Winthrop and the first settlers of Boston. ‘Biographical Stories,’ in a somewhat similar framework, tells of the lives of Franklin, Benjamin West and others. It should be noted of these books that Hawthorne's writings for children were always written with as much care and thought as his more serious work. ‘Our Old Home’ was the outcome of that less remembered side of Hawthorne's genius which was a master of the details of circumstance and surroundings. The notebooks give us this also, the American notebook has also rather a peculiar interest in giving us many of Hawthorne's first ideas which were afterward worked out into stories and sketches.

One element in Hawthorne's intellectual make-up was his interest in the observation of life and his power of description of scenes, manners and character. This is to be seen especially, as has been said, in his notebooks and in ‘Our Old Home,’ and in slightly modified form in the sketches noted above. These studies make up a considerable part of ‘Twice Told Tales’ and ‘Mosses from an Old Manse,’ and represent a side of Hawthorne's genius not always borne in mind. Had this interest been predominant in him we might have had in Hawthorne as great a novelist of our everyday life as James or Howells. In the ‘House of Seven Gables’ the power comes into full play: 100 pages hardly complete the descriptions of the simple occupations of a single uneventful day. In Hawthorne, however, this interest in the life around him was mingled with a great interest in history, as we may see, not only in the stories of old New England noted above, but in the descriptive passages of ‘The Scarlet Letter.’ Still we have not, even here, the special quality for which we know Hawthorne. Many great realists have written historical novels, for the same curiosity that absorbs one in the affairs of everyday may readily absorb one in the recreation of the past. In Hawthorne, however, was another element very different. His imagination often furnished him with conceptions having little connection with the actual circumstances of life. The fanciful developments of an idea noted above (5) have almost no relation to fact: they are «made up out of his own head.» They are fantastic enough, but generally they are developments of some moral idea and a still more ideal development of such conceptions was not uncommon in Hawthorne. ‘Rappacini's Daughter’ is an allegory in which the idea is given a wholly imaginary setting, not resembling anything that Hawthorne had ever known from observation. These two elements sometimes appear in Hawthorne's work separate and distinct just as they did in his life: sometimes he secluded himself in his room, going out only after nightfall; sometimes he wandered through the country observing life and meeting with everybody. But neither of these elements alone produced anything great, probably because for anything great we need the whole man. The true Hawthorne was a combination of these two elements, with various others of personal character, and artistic ability that cannot be specified here. The most obvious combination between these two elements, so far as literature is concerned, between the fact of external life and the idea of inward imagination, is by a symbol. The symbolist sees in everyday facts a presentation of ideas. Hawthorne wrote a number of tales that are practically allegories: ‘The Great Stone Face’ uses facts with which Hawthorne was familiar, persons and scenes that he knew, for the presentation of a conception of the ideal. His novels, too, are full of symbolism. 'The Scarlet Letter' itself is a symbol and the rich clothing of Little Pearl, Alice's posies among the Seven Gables, the old musty house itself, are symbols, Zenobia's flower, Hilda's doves. But this is not the highest synthesis of power, as Hawthorne sometimes felt himself, as when he said of 'The Great Stone Face,' that the moral was too plain and manifest for a work of art. However much we may delight in symbolism it must be admitted that a symbol that represents an idea only by a fanciful connection will not bear the seriousness of analysis of which a moral idea must be capable. A scarlet letter A has no real connection with adultery, which begins with A and is a scarlet sin only to such as know certain languages and certain metaphors. So Hawthorne aimed at a higher combination of the powers of which he was quite aware, and found it in figures and situations in which great ideas are implicit. In his finest work we have, not the circumstance before the conception or the conception before the circumstance, as in allegory. We have the idea in the fact, as it is in life, the two inseparable. Hester Prynne's life does not merely present to us the idea that the breaking of a social law makes one a stranger to society with its advantages and disadvantages. Hester is the result of her breaking that law. The story of Donatello is not merely a way of conveying the idea that the soul which conquers evil thereby grows strong in being and life. Donatello himself is such a soul growing and developing. We cannot get the idea without the fact, nor the fact without the idea. This is the especial power of Hawthorne, the power of presenting truth implicit in life. Add to this his profound preoccupation with the problem of evil in this world, with its appearance, its disappearance, its metamorphoses, and we have a clue to Hawthorne's greatest works. In 'The Scarlet Letter,' 'The House of Seven Gables,' 'The Marble Faun,' 'Ethan Brand,' 'The Gray Champion,' the ideas cannot be separated from the personalities which express them. It is this which constitutes Hawthorne's lasting power in literature. His observation is interesting to those that care for the things that he describes, his fancy amuses, or charms or often stimulates our ideas. His short stories are interesting to a student of literature because they did much to give a definite character to a literary form which has since become of great importance. His novels are exquisite specimens of what he himself called the romance, in which the figures and scenes are laid in a world a little more poetic than that which makes up our daily surrounding. But Hawthorne's really great power lay in his ability to depict life so that we are made keenly aware of the dominating influence of moral motive and moral law. See HOUSE OF THE SEVEN GABLES; MARBLE FAUN; SCARLET LETTER, THE; TWICE TOLD TALES.

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HAWTREY, Charles Henry, English actor-manager and playwright: b. Eton 1858, son of Rev. John Hawtrey. He was educated at Eton and Oxford, and became an actor when he was 23 years old His greatest success was in 'The Private Secretary,' adapted from Von Moser's 'Der Bibliothekar,' first produced in Cambridge in 1883. Other plays in which he has been successful are: 'Jane,' 'Mr. Martin,' 'A Message from Mars' and 'The Man from Blankley's.' With the last two plays he several times visited the United States.

HAXO SYSTEM OF FORTIFICATION. A bastion system of fortification introduced by Baron Francis Nicolas Benoit Haxo, a prominent French military engineer, employed by Napoleon, and later commanded at the siege of Antwerp in 1832. Casemated batteries of the system have earthen parapets along their front and are provided with arches mantled with earth. Apertures in front of the guns open into embrasures formed in extension of the parapet at these points. Being open in the rear the free circulation of air obviates the inconvenience of confined smoke.

The siege of this system of fortification is calculated to last 50 days and there are five distinct periods of breaching batteries: (1) Against the reduit of the salient place of arms and the ravelin. (2) Against the reduit of the re-entering place of arms, the coupures and the reduit of ravelin. (3) Against the bastionet and the counter-guard. (4) Against the retrenchment. (5) Against the bastion. The front is 360 yards long. The perpendicular is only 40 yards, and the faces 72 yards. The flanks are perpendicular to the lines of defense. The bastions contain interior retrenchments entirely separated from the rear by a ditch. A *chemin-des-rondes* surmounts the scarp of the enciente. The tenaille is not revetted and it has flanks that can mount three guns. The main ditch is 20 yards wide. The ravelin is made very salient, with a casemated traverse in capital, and coupures cut across its faces. In rear is a reduit of the ordinary outline, and behind is a casemated caponiere of bastionet, the roof of which carries 10 guns. The counterscarp of the main ditch is produced to within 10 yards of this bastionet, and in front of it slants a glacis, which closes the ditch of the ravelin and that of the reduit. The bastionet sweeps the interior glacis and co-operates with the flanks of the inner works to impede the construction of the counter-batteries.

The Haxo Casemate is a work built inside the parapet, arched and covered with earth, opening in the rear to the terreplein. The guns are protected from the enemy's fire, and can be entirely hidden by masking the embrasures.

HAY, John Milton, American statesman: b. Salem, Ind., 8 Oct. 1838; d. near Newbury, N. H., 1 July 1905. He was graduated from Brown University in 1858, and soon after leaving college entered the office of his uncle, Milton Hay, a former partner of Abraham Lincoln, in Springfield, Ill., to study law. In 1861 he was admitted to the bar, but did not practise; he took an active part in the campaign preceding Lincoln's first election and in 1861 went with Lincoln to Washington as one of the President's private secretaries. During the Civil War period he was also Lincoln's adjutant and aide-de-camp, and served in the field for some time under Generals Hunter and Gillmore. He was brevetted lieutenant and lieutenant-colonel.

After the death of Lincoln he went to Paris as secretary of legation, remaining there till 1867, when he returned to the United States. In the summer of the same year he became chargé-d'affaires at Vienna. After holding this post for a year, during which he had some opportunities for European travels, he resigned and returned to the United States, but was sent almost immediately to Madrid as first secretary of legation, where he remained till 1870.

During his service abroad he gained a valuable knowledge not only of the language and literature of the chief European nations, but also of foreign diplomacy and politics. On his return to the United States he took up journalism, was for a time on the editorial staff of the New York *Tribune*, and published, mostly in its columns, his 'Pike County Ballads.' After about five years of service on the *Tribune* he married a daughter of Amasa Stone of Cleveland and went to that city to live. He devoted himself mainly to literary work, and occasionally took part in politics, writing and speaking in presidential campaigns. In 1879 he accepted an offer from President Hayes to become first assistant Secretary of State under Mr. Evarts. He held this position till the end of the Hayes administration in March 1881; then he took charge of the *Tribune* during Whitelaw Reid's absence in Europe, and conducted it with marked success through the trying period of Garfield's assassination and death. The period 1881–97 was devoted to the business interests of his wife's family, to travel and especially to the writing, with T. G. Nicolay, of their monumental biography of Abraham Lincoln. During these years he also found more leisure to devote to other literary work, the result of which in the form of poems and a few prose articles was published in various magazines.

In March 1897 President McKinley appointed him United States Minister to England, and the selection was declared by all without distinction of party to be most suitable. In London he was well received, did much to bring about friendly understanding between England and the United States and to keep relations between the two countries on a most friendly basis during the difficult era of the war with Spain. His London experience was also most valuable training for the important position to which he was appointed in August 1898, when he became Secretary of State. Very few of those who had been at the head of the State Department had dealt with so many important questions as Secretary Hay, and probably none had been more thoroughly trained diplomats. At the time of the Boxer outbreak in China he was successful in obtaining justice for the Chinese, and preserving the integrity of the Chinese Empire, in 1899 he directed the United States Ambassadors at London, Berlin and Saint Petersburg to propose that each of these governments make a declaration in favor of the «open door» policy in China. They were invited to give assurances: first, that there would be no interference with any treaty port or vested interest; second, that the existing Chinese customs tariff would be continued without discrimination and administered by Chinese officials; third, that there would be no discrimination in harbor dues and railroad rates. France, Italy and Japan were afterward included in the negotiations. No treaties were exchanged, but all the governments approached pledged themselves by definite promises to the «open door» policy. He also negotiated and signed the Hay-Pauncefote Treaty (q.v.), and several reciprocity treaties, including one with Cuba; gave support to The Hague Conference (q.v.), and induced the Powers demanding indemnity from Venezuela to refer the question to The Hague tribunal; and, in 1903, signed within 48 hours of each other a treaty with the Colombian government granting right of way for the Panama Canal, and a treaty with Great Britain providing for the submission of the Alaskan boundary question to arbitration. During McKinley's first administration, also, Secretary Hay's position was of a peculiar significance, because, owing to the death in November 1899 of Vice-President Hobart, Hay would have become McKinley's successor had the President died or resigned before the end of the term. A similar condition existed after McKinley's assassination and death, when, by Roosevelt's succession to the Presidency, the Vice-Presidency became vacant again. Immediately upon Roosevelt's succession, the latter urged Hay to continue as Secretary of State, which he also did after his re-election. During the last few years of his service in the State Department John Hay's health was in a very precarious state and he continued in office only out of a deep sense of duty and in response to a general demand. He held honorary degrees of LL.D. from Western Reserve, Brown, Princeton, Dartmouth, Yale and Harvard. He is buried in Lake View Cemetery, Cleveland. In November 1910 the John Hay Library, built in his memory out of funds contributed by Andrew Carnegie and 28 other friends and admirers, was opened at his alma mater, Brown University, Providence.

Early in life he showed a deep interest in literature, an interest which he maintained from then on. He wrote a number of poems while still at college, among them the class poem which was considered quite above the average. His busy life, however, left comparatively little leisure to devote to literary work and his list of publications, therefore, is not very long. It includes 'Pike County

‘Ballads’ (Boston 1871); ‘Castilian Days’ (Boston 1871), one of the best books on Spain in the English language; ‘The Bread Winners’ (published anonymously, New York 1884); ‘Poems’ (Boston 1913); ‘The Complete Poetical Works of John Hay’ (Boston 1916). His addresses were published after his death as ‘Addresses of John Hay’ (New York 1906). In collaboration with J. G. Nicolay (q.v.) he wrote ‘Abraham Lincoln: A History’ (10 vols., New York 1890). It first appeared in serial form in the *Century Magazine* and is considered the most comprehensive and authoritative biography of Lincoln. Together with the same he edited ‘Complete Works of Abraham Lincoln, etc.’ (2 vols., New York 1894). Consult Brown University, Providence, R. I., ‘The Dedication of the John Hay Library, Nov. 11, 1910’ (Providence 1911); Chapman, A. S., ‘Boyhood of John Hay’ (in *Century Magazine,* Vol. LXXVIII, (n. s. Vol. LVI), p. 444, New York 1909); Howells, W. D., ‘Hay in Literature’ (in *North American Review,* Vol. CLXXXI, p. 343, New York 1905); Hunt, G., ‘The Department of State of the United States; Its History and Functions’ (New Haven 1914); Sears, L., ‘John Hay, Author and Statesman’ (New York 1914); Stedman, E. C., ‘John Hay’ (in ‘Poems,’ Boston 1908); Thayer, W. R., ‘The Life and Letters of John Hay’ (2 vols., Boston 1915); Ticknor, C., ed., ‘A Poet in Exile; Early Letters of John Hay’ (Boston 1910); United States, State Department, ‘History of the Department of State of the United States, etc.’ (Washington 1901); id., ‘Papers Relating to the Foreign Relations of the United States, etc.’ (Washington 1898–1905).

HAY, or FORAGE, the stems and leaves of grasses and other plants cut for fodder and dried in the sun. In haymaking the object of the farmer is to preserve the hay for winter use in the condition most nearly resembling the grass in its natural state. Of the various ingredients which compose grass, those portions which are immediately soluble in water are the most fitted for the purposes of nutrition; and therefore the mowing should be done when the plants contain the largest amount of sugar and other soluble matter. During the latter part of the process of fructification, when the seeds have arrived at maturity, the stem and leaves begin to decay; so that if the grass is not cut when in flower, a great amount of nutriment will be wasted. On the third day after mowing, if the weather is fine, the newly made hay will be ready for gathering into large windrows for carrying and stacking; but otherwise it will have to be put up into large cocks, and the carrying deferred until the next day. It is not desirable that grass should be too rapidly made into hay under a burning sun, as it is liable to scorch and lose its nutritive value. Great care must also be taken to preserve the hay from dew and rain, as water washes away the soluble salts and other matters, and when in the stack will cause fermentation, which, if excessive, destroys some of the most valuable properties of the hay. Some farmers salt their hay in stacking; others do not. Salt is generally commended. A good plan, when the hay harvest has been accompanied by wet weather, is to place a few layers of straw in the stack at intervals to absorb the moisture from the heating hay. On large farms the spreading out of the hay after it is cut down is performed by a haymaking machine drawn by a horse, which will do the work of 12 or 15 haymakers, and distribute the grass more thinly and evenly as it crosses the field. It is only for the haymaking of the true grasses, however, that it is adapted, as clover must not be shaken so violently. To be transported to markets at a distance, hay is now compactly pressed into bales by presses worked by hand or power. In fact baled hay has increased the importance of haymaking, owing to the readiness with which it can be transported by rail or water. On the Pacific Coast, especially in California, hay cut from alfalfa is very productive and profitable, and three or more crops a year are frequently obtained. In the United States 61,691,166 acres of land were utilized in cultivating hay and forage in 1900, the entire crop amounting to 84,011,299 tons, valued at $484,256,846.

The average value per acre of the hay and forage crop is $8. Included in the above estimate were 4,759,353 tons of cornstalks which were cut from fields cultivated mainly for the grain. These figures for 1900 show an increase in area since 1889 of 8,742,369 acres, or 16.5 per cent, and in production of 12,420,466 tons or 18.6 per cent.

Of this total area, 6.7 per cent was devoted to clover, 50.7 per cent to tame and cultivated grasses other than clover, 6.3 per cent to grains cut green for hay, 5.1 per cent to forage crops, 3.4 per cent to alfalfa or lucerne, 2.8 per cent to millet and Hungarian grasses, and 25.1 per cent to wild, salt and prairie grasses.

The North Central division contained 57.8 per cent of the total hay and forage acreage of the country, the North Atlantic 21.0 per cent, the Western 11.4 per cent, the South Atlantic 3.5 per cent and the South Central 6.3 per cent.

The rate of increase in area devoted to hay and forage since 1889 was greatest in the South Central division, being 103.0 per cent. The Western division shows an increase of 91.4 per cent, the South Atlantic of 12.2 per cent and the North Central of 10.7 per cent. The North Atlantic division shows a decrease of 2.2 per cent.

The total value of the hay and forage crop of 1900 averaged $135 per farm. The average yield per acre, exclusively of cornstalks, was 1.28 tons, and the average value per ton $6.11. The average yield per acre of the various classes was as follows: Forage crops, 2.62 tons; alfalfa or lucerne, 2.49 tons; millet and Hungarian grasses, 1.64 tons; grains cut green for hay, 1.28 tons; clover, 1.26 tons; tame grasses other than clover, 1.14 tons; and wild, salt and prairie grasses, 1.12 tons.

HAY FEVER, a nervous affection of the mucous membranes of the eyes, nose, mouth, pharynx, larynx, and bronchi, characterized by a profuse flow of secretion from the nose, and of tears from the eyes, and accompanied in some cases by asthma. It is induced by the lodgment on the mucous membranes of the eye, nose and throat of the wind-borne pollen of certain plants. The disease varies in its severity according to certain atmospheric conditions and the amount of pollen in the air. Occurring at the haying season the disease received its title through that association. The prevalence of

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catarrhal symptoms in summer separates it from an ordinary “cold in the head”; while their combination with difficulty of breathing prevents it being mistaken for spasmodic asthma, in which there is seldom any catarrh. There are three combining causes of this affection, which is largely nervous: First, a predisposing cause in some nervous disease, with a probable lesion in the fourth ventricle of the brain. Second, deformity, such as a deviating septum, in the nasal region. Third, inhalation of a special pollen. Removal to the seashore or the mountains is beneficial in most cases, and a sea voyage, or other complete removal from pollen afflicted regions brings entire release. The succinimide of mercury affords relief in many cases, and arsenic, iodides, bromides, and other nerve specifics benefit others. For the asthma, iodide of potash, 5 grains with 5 minims of tincture of belladonna in syrup of orange-peel should be taken every two hours. Calcium chloride is also very effective where asthmatic symptoms are marked. Inhalations of nitre-paper, stramonium leaves, etc., with wine of coca internally, are also useful.

These remedies are, however, merely palliative, and scientific men have been for some time making investigations which may eventually lead to the discovery of a radical cure.

Professor Dunbar, of Hamburg, who has been studying the subject for seven years, is one of those who hold out the hope for curing hay fever by a rational treatment.

According to him, the disease is caused by the pollen of grasses, but not by mechanical irritation. He has extracted from the pollen a protein poison, or toxin, which is insoluble in ether and alcohol, but soluble in water and weak saline solutions, tears, the mucus of the nose and the serum of blood. A solution of this toxin dropped into the eye or nose at once produces the characteristic symptoms of hay fever. The same symptoms in an aggravated form occur when the solution is injected hypodermically.

This discovery suggested treatment by the serum method and Dr. Dunbar set to work to produce a curative serum by inoculating animals with pollen toxin, and a serum was eventually obtained which, when dropped into the eye or nose together with pollen toxin, completely prevented the attack which the latter alone would have caused. In practical use, however, both the serum and the vaccination treatments have failed, and it is now generally admitted that the only completely effective treatment is avoidance of the cause.

Recent investigations have established the fact that hay fever is a distinctly preventable disease. Where there is none of the poisonous pollen the disease does not exist. The fact of prime importance is that only wind-borne pollen produces the disease. The pollen of golden rod, daisies, dandelions, and sunflowers will produce the symptoms if directly inhaled, but at a little distance such plants are harmless: their pollen is too heavy to be carried by the wind. On the other hand it has been found that some pollen travels several miles on the wind, but the farther it goes the more widely it is scattered, and it is rarely in sufficient quantity to produce the disease beyond half a mile from its source. Another established fact of importance is that immunity from the disease does not imply that the immune person is not inhaling pollen, but simply that he is not inhaling more than his system can resist. It is only when the pernicious toxin of the pollen is assimilated beyond the capacity of resistance that the symptoms appear. After an attack is definitely begun, a much smaller addition of the toxin is sufficient to keep it going. The very wide degree of personal resistance to the pollen toxin explains the susceptibility of some persons and the immunity of others breathing the same pollen and in the same quantities. Unfortunately an attack of the disease leaves the patient more susceptible than before. Curiously, however, farm workers who are continually breathing pollen do not have hay fever.

The earlier summer cases of hay fever are attributed to the pollen of several of the grasses, and to that of the yellow dock (*rumex crispus*). The midsummer cases are said to be due to “careless weed” (*amaranthus spinosus*) and cocklebur (*xanthium Canadense*). The much larger proportion of cases of the early autumn are unquestionably due to the pollen of the ragweeds *ambrosia trifida* and *ambrosia elatior*. The marsh elder (*iva ciliata*) is also credited with a share in the scourge. The official experiment of cutting the ragweeds in and about New Orleans in the summer of 1915 resulted in shortening the “season” of hay fever in that city by several weeks. The output of pollen was so reduced within a half-mile distance from the city as to render it innocuous except to the most susceptible, and these eventually escaped by temporary removal to the centre of the city, beyond the reach of the pollen-laden winds.

HAY-PAUNCEFOTE TREATY, signed 18 Nov. 1901, which replaced the Clayton-Bulwer Treaty (q.v.) as an Anglo-American agreement of policy regarding an isthmian canal, then supposed to be fixed as across Nicaragua. It was drawn up by John Hay, Secretary of State, and Sir Julian Pauncefote, ambassador from Great Britain. Public feeling for some years had been growing so sore over the Clayton-Bulwer Treaty's restriction on the independent action of the United States, that there was grave fear lest Congress might abrogate it by open violence, a great blow to future amicable action. President McKinley voiced the feeling by the declaration, in his annual message for 1898, that the canal had become a national necessity. Fresh negotiations were opened with Great Britain; that country had no wish beyond that of neutralizing the canal, and sent one of her best diplomats with very liberal instructions, to concede whatever did not nullify that essential principle. The draft treaty was sent to the Senate by the President 5 Feb. 1900. It provided that a canal might be constructed by the United States, or under its direction; should be permanently neutralized on the basis of the Suez Canal agreement — to be kept open at all times, either of war or peace, to all vessels, without discrimination, and no fortifications to be constructed commanding the canal or the waters adjacent, and that other powers should be invited to join in this guaranty of neutrality. The provisions excited intense hostility, and Senator Davis offered an amendment adopted by the committee on foreign affairs, canceling the very features for which it was drawn up, and which made the spirit of the previous one. It provided that the neutralization clause should not prevent the United States from any measures it thought needful for its own defense or the preservation of order, declared the Clayton-Bulwer Treaty specifically abrogated, and struck out the third clause inviting the concurrence of other powers. In this form it was ratified by the Senate 20 Dec. 1900, but Great Britain refused to accept the transformed treaty, and it expired by limitation on 5 March 1901. Undiscouraged, the two diplomats set to work on a compromise, which was signed by them 18 Nov. 1901, sent to the Senate by President Roosevelt, and ratified by them 16 December. The chief differences were in dropping as far as possible all specific guaranties, requirements or prohibitions, leaving its interpretation and application to the chapter of fate and the certainty that the strong hand would decide in any event. The neutrality of the canal is not guaranteed at all except by the terms of the agreement, the Clayton-Bulwer Treaty is abrogated by name, and the United States is not forbidden to construct fortifications, nor required to keep the canal open in time of war.

Prior to the opening of the Panama Canal to traffic on 15 Aug. 1914, a controversy with Great Britain respecting the interpretation of the Hay-Pauncefote Treaty had arisen. Under the Panama Canal Act of 1912, passed by Congress; American vessels engaged in the coastwise trade were to be exempted from canal tolls. Sir Edward Grey, the British Foreign Secretary, lodged a protest against the passing of the measure, and claimed that the act was a discrimination against British and other foreign vessels in contravention of the treaty, and requested that the bill be held in abeyance in the Senate in order that a detailed statement might be sent; but President Taft signed the act on 24 Aug. In the formal protest subsequently lodged (9 Dec.), Sir Edward Grey declared that «while the Hay-Pauncefote Treaty left the United States free to build and protect the canal, it expressly maintained the principle of Article VIII of the Clayton-Bulwer Treaty of 1850, guaranteeing to England the use of the canal on a complete equality with the United States of America»; and he later (27 Feb. 1913) pressed for arbitration. In the United States the British contention was generally regarded as an attempt to interfere with that country's sovereign rights to deal with its own commerce, and to use the canal in whatsoever manner it saw fit — though a minority, led by Senator Root, stoutly held that the British objection was based on solid grounds. All the correspondence on the subject had passed before President Wilson came into office. On 5 March 1914 he sent a message to Congress strongly urging the repeal of the exemption. He regarded the exemption as a plain breach of the Hay-Pauncefote Treaty, and declared that it was only in the United States that there was any doubt as to its language. He proposed a «voluntary withdrawal from a position everywhere questioned and misunderstood.» In spite of strong opposition, repeal of the exemption was finally accepted, but not before a proviso had been inserted in the bill expressly reserving to the United States the right to exempt ships in the future.

HAY RIVER, a stream which rises in the Rocky Mountains in Athabasca, Canada, and flows northeast into Great Slave Lake. It is navigable for about 140 miles from its mouth; its entire length is about 360 miles. The two Alexandra Falls (named after Princess Alexandra, now Queen Alexandra of England) are found in the upper course; they average about 250 feet in height and 900 feet in width.

HAY-WORM, the caterpillar of a medium-sized pyralid moth (*Pyralis costalis*), injurious to clover hay, and to other hay when mixed with clover. Its depredations can be prevented by keeping the hay dry and well ventilated, as the insect preferably breeds in moist or matted material such as is to be found in the lower parts of stacks; here the hay becomes filled with webbings of the «worms» and their excrement, rendering it unfit for feeding. The webbed material should be burned and the place thoroughly cleaned.

HAYASHI, hä'yą-shē, **Count Tadasu,** Japanese statesman and diplomat b. Sakura, 1850; d. Tokio, 10 July 1913. As a boy he lived in the house of an American missionary to learn English, and later was one of the first students sent by the Japanese government to London, where he studied at the University College School. Entering the civil service on his return home he became secretary in the Central government and subsequently governor of Kagawa-ken and Hyogo-ken. He served as Vice-Minister in the Foreign Office from 1891 to 1896, when he was appointed Minister at Peking. In 1898 he was transferred to Saint Petersburg (Petrograd) and in the following year to London. During the six years he spent in London he was largely responsible for the promotion of the two treaties between Great Britain and Japan in 1902 and 1905, both of which he signed. In 1904 the Japanese legation in London was raised to the dignity of an embassy, and Viscount Hayashi thus became the first Japanese Ambassador. The rank of count was conferred on him in 1907. He held ministerial portfolios in the Saioryi cabinets in 1911 and 1912. At the farewell banquet given in his honor by the Lord Mayor of London, the Ambassador assured his audience that the Japanese people firmly intended to maintain the word and spirit of their engagements, and that the sympathy of the British Empire toward Japan was reciprocated to the fullest extent. Count Hayashi was the recipient of honorary degrees from the universities of Oxford and Cambridge. In 1903 he published in English a book entitled 'For his People,' and has also translated into Japanese several English and European classical works on politics and political economy.

HAYDEN, Ferdinand Vandeveer, American geologist: b. Westfield, Mass., 7 Sept. 1829; d. 22 Dec. 1887. He was graduated from Oberlin College, Ohio, studied at the Albany Medical College, and during the greater part of 1853–62 was employed in surveys in the northwest. He served as surgeon in the Union army during the Civil War, and was professor of mineralogy and geology in the University of Pennsylvania 1865–72. In 1867–69 he made a geological survey of Nebraska, and was afterward director of the geological survey of the Territories of the United States, until in 1879 the various national surveys were combined in the geological survey of the United States. Till 1886 he remained at the head of the Montana division. He published many papers, besides numerous and valuable government reports, and was a member of many scientific societies at home and abroad.

HAYDN, hä'dn (Ger. hī'dn), **Franz Joseph**, Austrian musical composer: b. Rohrau, on the borders of Hungary and Lower Austria, 31 March 1732; d. Vienna, 31 May 1809. He was the son of a traveling wheelwright who was fond of music and taught his 12 children. Young Franz showing exceptional talent, he was trained by his cousin, a schoolmaster at Hainburg, where from six to eight years of age he learned reading, writing, singing by note, and to play on such instruments as his childish strength would admit of his handling. His voice attracted the notice of the parish priest, who recommended him as a choir-boy to the chapel-master of Saint Stephen's in Vienna, and at eight Haydn was received into the choir. With the exception of some Latin and much practical music he seems here to have been taught nothing; in the theory and science of the art he received but two lessons from his master in eight years. At last in his 16th year, his voice began to break and he lost his place, but helped by some friends he took up his abode in an attic in the Austrian capital, intending to live by his art. At that time the first six sonatas of Emmanuel Bach fell into his hands. «I could not leave my instrument,» he said in his old age, «until I had played them through; and anyone who knows me must perceive how much I owe to Emmanuel Bach, that I studied him carefully, and comprehended him.» After a time he became acquainted with Metastasio, the greatest operatic librettist of the time. The poet had charge of the education of a Signora Martinez, and Haydn was employed to give her elementary instructions in music. This afforded him an opportunity for mastering Italian, and what was of more immediate importance, procured him board and lodging. Metastasio introduced the struggling young artist to Porpora, a celebrated Italian musician, then in Vienna. As Porpora's accompanist he attracted the attention of Gluck and other masters, and his prospects from this time onward grew steadily brighter. He was often engaged to play at the musical entertainments given by the Austrian nobles, was appointed organist of two churches, sang tenor parts in the choir of another and pupils rapidly became more numerous. He wrote a short comic opera, ‹Der hinkende Teufel› (The Limping Devil), which was given three nights with applause, but owing to the satirical character of the libretto was forbidden by the police. Having now the means, Haydn purchased and studied the theoretical works of Emmanuel Bach, Mattheson and Fux. In 1759 Count Morzin engaged him as music composer and director at a salary of 200 florins, with free lodgings and table with his secretaries and other officials. The following year he became assistant-kapellmeister to Prince Paul Esterhazy, and in 1766 full kapellmeister or musical director to Prince Nicholas Esterházy, remaining in their service for 30 years. Anything like a catalogue of his compositions during this time is impossible; much was destroyed on three separate occasions when his house was burned down and much was scattered; but they included 163 pieces for the baryton, an obsolete instrument in size between the viola and the violoncello; about 120 symphonies for full orchestra; more than 100 works of chamber music of the higher forms, and 12 Italian operas performed in his patron's private theatre. Haydn married in 1759 but the union was incompatible and resulted in a separation. On the death of Prince Esterhazy, in 1790, Haydn visited London where the musical world received him with the greatest enthusiasm. Oxford University conferred on him the degree of Doctor of Music, and his stay lasted 18 months. Here he produced an opera, ‹Orfeo,› nine symphonies, six quartettes, 11 sonatas, several songs and canzonets and the accompaniments to more than 100 Scotch songs. He visited London a second time in 1794, his stay lasting a like period, and on his return to Vienna set about composing the music of the oratorio, ‹Creation,› the words adapted by Linley from Milton's ‹Paradise Lost.› Haydn thought the text too long, and not being thoroughly acquainted with English, had it translated and curtailed by Baron von Swieten. It was produced 19 March 1799, when its author was in his 66th year. It obtained a great success and he was induced to undertake the music of another text prepared from Thompson's ‹Seasons.› This work wants the freshness and vigor of the previous work; which may have resulted in some measure from the barren unpoetical text. Among the compositions of his declining years were some of his finest chamber music, the Austrian national Anthem and several masses; the last, his mass in C minor, was written in 1802. He died during Napoleon's occupation of Vienna, and many French officers were among the mourners at his funeral. Consult Cowan, F. H., ‹Haydn› (New York 1912); Brenet, M., ‹Haydn› (Paris 1909); Nohl, L., ‹Life of Haydn› (Chicago 1889); Pohl, C. F., ‹Mozart and Haydn in London› (Vienna 1867); id., ‹Josef Haydn› (2 vols., Leipzig 1875–82).

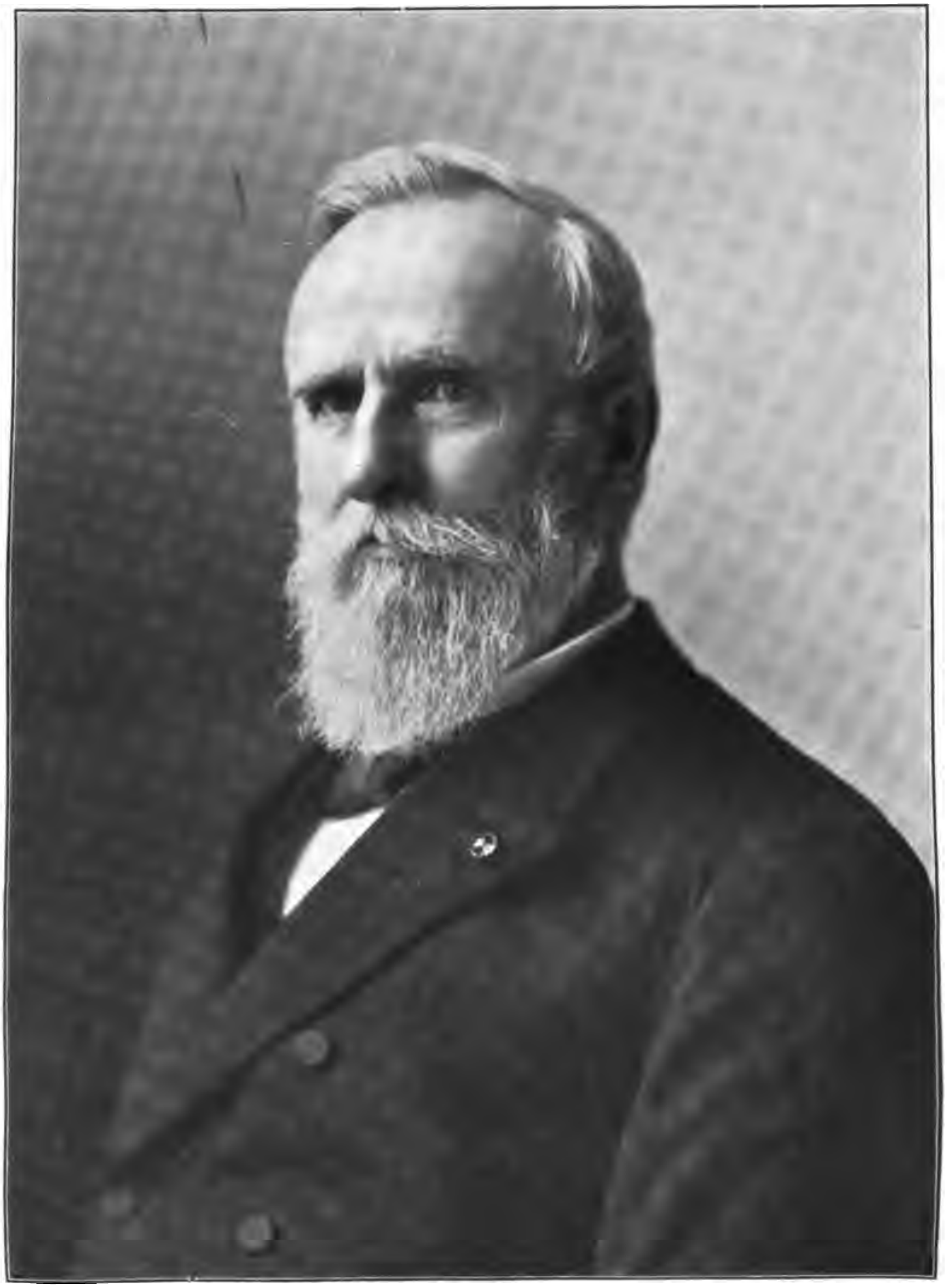
HAYES, Augustus Allen, American chemist: b. Windsor, Vt., 1806; d. Brookline, Mass., 21 June 1882. He began his studies under Dana, and was successful throughout his career in improving the resources of applied chemistry to a remarkable extent. He was the first to extract the alkaloid sanguinarin from the blood root, *Sanguinaria Canadensis*. He also improved the common method of reducing pig to malleable iron and discovered new processes in copper-smelting. His researches led him also to a new formula for the production of chloroform. He was for many years employed by the State of Massachusetts as assayer.

HAYES, Isaac Israel, American arctic explorer: b. Chester County, Pa., 5 March 1832; d. 17 Dec. 1881. He was graduated in medicine at the University of Pennsylvania in 1852, and began his arctic experiences as surgeon in the second Grinnell expedition sent out under Captain Kane in 1853, in search of Franklin. Becoming convinced of the existence of an open polar sea, he was enabled to obtain funds for the expedition on which he sailed in the ship *United States* from Boston in 1860. He had two astronomers on board and according to their observations reached lat. 81° 35′ N., long. 70° 30′ W., the farthest point north hitherto recorded in any voyage. In 1869 he made a voyage to Greenland: He received gold medals from the geographical societies of Paris and London. His published works comprise 'An Arctic Boat Journey' (1860); 'The Open Polar Sea' (1867); 'Cast Away in the Cold' (1868); and 'The Land of Desolation' (1872).

HAYES, Patrick Joseph, American Roman Catholic prelate: b. New York city, 20 Nov. 1867. He was educated at Saint Andrew's parochial school, De La Salle Institute, and in 1888 was graduated at Manhattan College. His theological studies were made at Saint Joseph's Seminary, Troy, and on 8 Sept. 1892 he was ordained to the priesthood. After ordination he attended the Catholic University, Washington, from which he received the degree of D.D. Father Hayes was appointed assistant of Saint Gabriel's, in East 37th street, and for a time served as secretary to Archbishop Farley, who in 1903 made him chancellor of the archdiocese and rector of the newly-founded Cathedral College. On 28 Oct. 1914 Father Hayes was consecrated titular bishop of Tagaste, becoming also auxiliary bishop of New York. In 1915 he was made permanent rector of Saint Stephen's, New York. In 1917–18 Bishop Hayes was bishop ordinary of all Catholic chaplains of the United States forces. On 27 Feb. 1919 was announced his appointment to the archbishopric of New York in succession to the late Cardinal Farley.

HAYES, Rutherford Birchard, 19th President of the United States: b. Delaware, Ohio, 4 Oct. 1822; d. Fremont, Ohio, 17 Jan. 1893. He was the third son of Rutherford and Sophia (Birchard) Hayes. His earliest paternal ancestor in America was George Hayes, a Scotchman, who, prior to 1680, settled in Windsor, Conn.; was married to Sarah Dibble, and in 1698 removed to the Salmon brook district, Simsbury, now in Granby township. In 1817 the family moved to Ohio from Brattleboro, Vt. An uncle took particular interest in young Rutherford, and supplied his eager demand for books. In 1834 he took up the study of Latin and Greek under the direction of Judge Sherman Finch, of Delaware, who had been a tutor at Yale. He continued his studies in the Norwalk (Ohio) Academy, and completed his preparatory course at Middletown, Conn., under Isaac Webb. At 16 he entered Kenyon College, from which he was graduated in 1842 as the valedictorian of his class. The following year he entered the law school of Harvard University, where he remained until 1845, at the same time studying French and German and attending the lectures of Agassiz on natural science and of Longfellow on literature. He was admitted to the Ohio bar at Marietta, 10 May 1845, established himself at Lower Sandusky, now Fremont, and in April 1846 formed a law partnership with Ralph P. Buckland, then a member of Congress and later a major-general in the Civil War. Early in 1848 his health having failed, he wanted to enlist in the war with Mexico, but he was forbidden to do so by his physician, and, after trying the climate of New England and of Canada, he spent the following winter in Texas. Returning to Ohio with health fully restored, he settled in Cincinnati in December 1849. In 1856 he was nominated for the office of common pleas judge, but declined the honor. His public life began two years later, when the office of city solicitor became vacant, and he was elected by the council to complete the unexpired term. In 1859 he was elected to the same office by the citizens, and he performed his duties with ability until April 1861, when he was defeated for re-election.

A Whig in politics, Hayes had cast his first vote for Henry Clay in 1844, his second for General Taylor in 1848, and his third for Winfield Scott in 1852; but having been opposed to slavery from his youth, he joined the Republican party and supported Frémont with enthusiasm in 1852, and Lincoln in 1860. On 13 April 1861, at a mass-meeting, called in response to President Lincoln's proclamation asking for 75,000 troops, he was made chairman of the committee appointed to draw up resolutions expressive of the intense feeling which had now been aroused. Forthwith the members of his literary club organized a military company and he was chosen captain. President Lincoln sent him a commission as colonel of volunteers, but he declined it. Later, 1 June 1861, he accepted a commission from Governor Dennison as major of the 23d Ohio Volunteer Infantry, a body of 900 men, of which W. S. Rosecrans was colonel and Stanley Matthews, lieutenant-colonel. This regiment was ordered into West Virginia, under Gen. George B. McClellan, to aid in driving the Confederates from that section. From 19 Sept. 1861 Major Hayes was judge-advocate of the Department of the Ohio for about two months. During the summer of 1862 his command was transferred to the Army of the Potomac, and participated in the battle of South Mountain, where, though wounded in the arm, he led a charge and held his position at the head of his men. For his conspicuous gallantry on this occasion, he was made colonel of the 23d Regiment on 24 Oct. 1862. He was detailed from his regiment to act as brigadier-general in command of the celebrated Kanawha division; checked the raid of the Confederate, John Morgan, in July 1863, and aided in preventing his force from re-crossing the Ohio and in compelling its leader to surrender. He commanded a brigade under General Crook in the spring of 1864, which took part in cutting the principal lines of communication between Richmond and the Southwest, and he led it in storming a fortified position on the crest of Clay's Mountain. Later, still under Crook, he joined Hunter's army in the march against Lynchburg, and covered the retreat in the dangerous passage of the Alleghanies. In the first battle of Winchester, 24 July 1864, Colonel Hayes and Col. James Mulligan were ordered to charge what proved to be a greatly superior force. Mulligan fell, but Hayes flanked and conducted the retreat of his brigade with great intrepidity and skill, eventually checking the pursuit. At Perryville he also served with credit and at the second battle of Winchester, 19 Sept. 1864, performed an act of signal bravery. Advancing against a battery situated on an eminence, he suddenly came to a deep slough, some 50 yards in width. Nevertheless, he plunged in at once, and, although his horse sank in the mire, he extricated himself, climbed to the top of the other bank, and, with about 40 who followed, charged the battery and put its defenders to flight. He led a division at Fisher's Hill,



RUTHERFORD BIRCHARD HAYES

Nineteenth President of the United States

22 Sept. 1864, where he gained the enemy's rear and routed them, capturing several pieces of artillery. A month later, he was engaged at Cedar Creek, where while in retreat he had a horse shot under him and he was slightly wounded in the head. A few days later he was made brigadier-general and on 13 March 1865 was brevetted major-general for his distinguished services at Fisher's Hill and Cedar Creek. While still in the army, 6 Aug. 1864, he was nominated for Congress from the Second Ohio district. He was elected to the 39th Congress, and he was nominated for governor by the soldiers in the field. In August 1866, he was renominated by acclamation and was elected to the 40th Congress by a large majority. In Congress he was appointed chairman of the library committee and succeeded in greatly amending the copyright law, as well as in trebling the area, contents and usefulness of the Congressional Library. His votes in matters affecting the reconstruction of the South were given with his party; his first vote was for a resolution affirming the sacredness of the public debt and denouncing every form of repudiation. He sustained the movement for the impeachment of President Johnson. In 1867 he was nominated for Governor of Ohio by the Republicans. He was elected with his Republican associates in November. He steadily increased in personal popularity and was re-elected governor in 1869. During his administration he carried out a comprehensive geological survey of Ohio, which was of great advantage in the development of the mineral resources of the State. The State debt was reduced by nearly $3,000,000 and considerable reforms brought about in regard to the debt incurring powers of municipalities. In 1872, he returned to Cincinnati determined to retire from public life, and in 1873 he moved to his old home at Frémont. In 1875, however, he was nominated governor and was with difficulty induced to accept the nomination. The great issue of the campaign was the money question, which though properly a national issue, had been forced into State politics. There were those who believed and publicly contended that all that was needed to make money was the stamp of the government of the United States, that it was not necessary to have back of it any intrinsic value. Hayes, however, stood for «sound money,» and after an active campaign won the election, thus becoming governor of Ohio for the third time.

The Republican State Convention of Ohio named him as its choice for President in the Republican National Convention. When the latter body met, at Cincinnati, 14 June 1876, his name was presented, as were the names of other prominent leaders of the party, including that of James G. Blaine. It soon became evident that none of the recognized candidates could be nominated and a «dark horse» was looked for. On the seventh ballot the opposition to Mr. Blaine gave Mr. Hayes the nomination. The Democratic party nominated Samuel J. Tilden, whose reputation as a reformer brought him the support of many dissatisfied Republicans. The result of the election was a question of long and bitter contest. The electoral votes of Louisiana, Florida and of South Carolina were in dispute and both sides charged their opponents with fraud. The canvassing boards of the States in dispute were visited by statesmen of both parties, all blinded in a measure by political prejudice. The governors of the disputed States gave certificates in favor of Mr. Hayes, but other officials gave the same document in favor of Mr. Tilden. At last a commission was appointed to decide which set of papers was legal. This commission consisted of five Senators, five Representatives and five justices of the Supreme Court. When this plan was agreed to chance favored the Democrats, owing to the composition of the Supreme Court; but while the commission was being organized, Justice Davis, who was expected to be a member and to favor Mr. Tilden, was elected a Senator and so forced to resign his seat in the Supreme Court. This led to the substitution of Justice Bradley, a strong Republican, whose vote decided the question, for the commission on every question divided eight to seven. The electoral vote, as decided by the commission was 185 for Hayes and 184 for Tilden. Mr. Hayes was publicly inaugurated 5 March 1877. He at once proceeded to satisfy the Southern States by withdrawing from them the Federal troops and leaving the local government to the people in the two disputed States then under a dual government. This course, while heartily approved by the Democrats, was severely criticized by the Republicans, who thus lost the votes of the Southern States. As regards appointment to office, Mr. Hayes' general policy was to respect the views of the advocates of civil service and his appointments were in general very acceptable. Competitive examinations were instituted and applications were considered irrespective of party affiliations. On 5 May 1877 President Hayes called Congress in extra session, to meet 5 Oct. 1877, to make necessary appropriations for the support of the army. In July he suppressed the railroad riots caused by a strike, on application from the governors of West Virginia, Maryland, Illinois and Pennsylvania, by sending United States troops to the points of disturbance. In his message to Congress, 3 Dec. 1877, he congratulated the country on the peaceable and prosperous condition of affairs in the Southern States; recommended the payment of government bonds in gold; favored the limited coinage of silver; insisted that the Constitution imposed on the President the sole duty and responsibility of the selection of Federal officers and recommended that Congress make a suitable appropriation for the use of the civil service commission; and recommended the passage of laws to protect the forests on lands of the United States — all of which were disregarded. He vetoed the «silver bill,» on the ground that the commercial value of the silver dollar was then less than its nominal value, and that its use in the payment of debts already contracted would be an act of bad faith; the bill was passed over his veto. In his message of 1 Dec. 1879 he congratulated the country on the return to specie payment, and urged upon Congress the suspension of silver coinage, fearing that the cheaper coin would eventually be the sole standard of value; and recommended the retirement of United States notes with the capacity of legal tender in private contracts. In his message of 6 Dec. 1880 he again urged civil service reform, competitive examinations for applicants for positions, for a law against political assessments, and suggested that an act be passed «defining the relations of members of Congress with regard to appointments to office by the President,» that the tenure of office act be repealed, etc. Throughout his administration his actions gave great offense to the politicians who had placed him in office, and both Houses of Congress were up in arms against a President who insisted upon putting empty campaign promises into practice. They refused to pass the necessary appropriation bills, even the one for the support of the army. When these measures were eventually carried through, attached to them were certain «riders» repealing obnoxious laws. This proceeding President Hayes considered an infringement on his prerogative, so he vetoed the bills, stood firm, and, in the end, won the battle. Owing to this quarrel with the politicians his re-nomination was out of the question, and on 4 March 1881, he relinquished his office to President Garfield. At the close of his administration, Mr. Hayes returned to private life. His interest in education was shown by the work done as a member of the boards of trustees of the Ohio Wesleyan University at Delaware and the Ohio State University at Columbus. Hayes' Hall at the latter institution bears his name because of his devotion to the cause of manual training. He was also president of the John F. Slater Educational Fund and gave much time to its proper distribution. As president of the National Prison Reform Association he did much to educate the public to a more humane way of thinking about the treatment of convicts, many of his public utterances have become maxims in prison management, and his work along these lines has been exceedingly valuable and permanent in its results. Consult Gladden, 'The Great Commoner of Ohio' (Columbus 1893); Stoddard, 'Hayes, Garfield, and Arthur' (New York 1889); Howard, 'Life, Public Services, and Select Speeches of Rutherford B. Hayes' (Cincinnati 1876); Howells, 'Life of R. B. Hayes' (New York 1876); Conwell, 'Life and Public Services of Governor Hayes' (Philadelphia 1876). Consult also Haworth, 'The Disputed Election of 1876' (Cleveland 1906), and Bigelow (editor), 'Letters and Literary Memorials of Samuel J. Tilden' (Vol. II, New York 1908).

HAYES RIVER, Canada, called Hill River in the upper part of its course, rises near Lake Winnipeg and for about 300 miles flows northeast through Oxford or Holy Lake, Knee Lake and several other lakes, into James Bay, near the mouth of the Nelson River. The largest tributaries are the Shamattawa and the Fox.

HAYESINE, hā'zĭn, a hydrous borate of calcium ($CaB_4O_7.6H_2O$), occurring as snowy-white, silky flakes, floating in the waters of hot springs in Chile, and also as a flocculent sediment on the bottom. It is a somewhat uncertain species and has been regarded as a form of bechilite, but has been identified as ulexite. In the United States, specimens are reported from Bergen Hill, N. J., where it is associated with datolite. (Named in honor of A. A. Hayes (q.v.), an American chemist).

HAYGOOD, Atticus Green, American Methodist bishop: b. Watkinsville, Ga., 19 Nov. 1839; d. Oxford, Ga., 19 Jan 1896. He was educated at Emory College, Ga., of which he was president 1876–84, becoming in 1890 bishop of the Methodist Episcopal Church South. He wrote 'The Monk and the Prince,' a study of Savonarola and Lorenzo de Medici; 'Our Brother in Black' (1881); 'Pleas for Progress' (1889).

HAYMARKET SQUARE RIOT, a disturbance resulting in the murder of several policemen in Chicago, 4 May 1886, by a bomb thrown by an anarchist. The labor troubles had long been exploited by the «practical» anarchists (with whom the philosophic anarchists disclaim connection), who denounced the efforts for shorter hours and better wages as tending merely to aggravate capitalistic slavery, and urged instead the general seizure of property and the murder of its owners. In February 1886 the McCormick Reaper Works had been closed on account of a demand for the expulsion of some non-union men, but had reopened. Meantime a great eight-hour strike had left some 50,000 workmen unemployed in the city, and in view of an almost certain conflict with the police, George Engel proposed at a meeting in Bohemian Hall on 2 May, and the meeting indorsed, a plan to blow up the police stations, shoot the emerging police, cut the telegraph wires, fire buildings to engross the service of the fire department and make a general jail delivery, that the prisoners might aid in a social revolution. The next day August Spies and others incited a meeting of the Lumber-shovers' Union, 16,000 or more, principally Germans and Bohemians, to assail the McCormick Works in order to furnish an opportunity for carrying out this plan, though the works had no connection with this union. The mob attacked the works with stones and revolvers, but were driven off. No one was fatally injured, but Spies immediately issued a circular headed «Revenge!» asserting that six workingmen had been killed and calling their brethren to arms. He also published a fierce article in his paper, the *Arbeiter Zeitung*, repeating the falsehood and declaring that there had been a «massacre» to terrorize the workingmen, who should have had dynamite bombs instead of stones.. In the evening a meeting was held at Greif's Hall, at which Engel's plan was adopted. Spies, Albert R. Parsons, Samuel Fielde and Oscar W. Neebe spoke for a mass-meeting to further the plan above mentioned; at Adolf Fischer's suggestion it was fixed for next evening in Haymarket Square, that the dusk and the room for a great crowd might furnish more confusion and better means of escape. Rudolph Schnaubelt wished to have all socialists in other cities notified, so that there might be a general revolution. The signal was to be «Ruhe» (Peace), which was printed in next afternoon's *Arbeiter Zeitung*. Meantime Louis Lingg and others worked all day preparing bombs, of which the newspaper office was found to be an arsenal, along with firearms, and with a confederate carried a satchel of them to a place where others helped themselves. The air was full of rumors of intended violence and the mayor (Carter Harrison, Sr.) ordered the police to mix with the meeting and disperse it if incendiary language were used, and 176 policemen were concentrated at the nearest station. Spies and Parsons spoke first, but the mayor was in the crowd and they used mild language, till his suspicions were lulled and he left. Then Fielde began a frenzied and bloodthirsty harangue, calling for the «extermination» of the capitalists. The crowd grew so wild that shortly after 10 the police in four divisions appeared and covered the street, and while Fielde was speaking, Captain Ward ordered the crowd to disperse. Fielde called out «We are peaceable» (curiously like «Peace»), and a bomb was at once thrown into the midst of the police, which exploded and caused frightful carnage, killing or mortally wounding eight policemen and injuring a great number more. The mob instantly followed it up with a volley from rifles and revolvers, proving that they had been expecting the signal, but the police at once rallied and charged the mob, dispersing it in disorder. Of the police, besides those killed, 68 were wounded by shot or bombs, many maimed for life. Spies, Parsons, Fischer, Engel, Lingg, Fielde, Michael Schwab and Neebe were arrested and tried as accessories before the fact: the first four were hanged 11 Nov. 1887; Lingg shattered his jaw in prison with a bomb and died; Fielde and Schwab were sentenced to prison for life and Neebe for 15 years. There was considerable dissatisfaction with this verdict throughout the country, even amongst people not in sympathy with the anarchists because none of the men had been clearly proven to have thrown the bomb. The last three were pardoned by Governor Altgeld (q.v.) in 1893, many prominent men of Chicago and throughout the country having petitioned for their release on the ground that the evidence did not connect them with the actual throwing of the bomb, which was true, the evidence pointing strongly to Schnaubelt. Consult Altgeld, J. P., 'Reasons for Pardoning Fielde, Neebe and Schwab' (Chicago 1893); Buchanan, J. R., 'Chicago Anarchists' (in *Outlook*, Vol. LXXVI, p. 117, New York 1904); Hill, F. T., 'Decisive Battles of Law' (New York 1907); Holmes, W., ed. 'The Chicago Martyrs, etc.' (in *Free Society Library*, No. 1, San Francisco 1899); Russell, C. E., 'These Shifting Scenes' (New York 1894); Supreme Court of Illinois, Northern Grand Division, 'August Spies et al. *v.* the People, etc.' (Chicago 1887).

HAYNE, Isaac, American patriot: b. «Hayne Hall,» near Jacksonboro, S. C., 23 Sept. 1745; d. Charleston, S. C., 4 Aug. 1781. He was a wealthy planter who took up arms after the invasion of the colony by the English forces, and after the capitulation of Charleston was paroled with the proviso that he would not be ordered to bear arms against his countrymen. He was summoned, however, to the English standard and refusing compliance as a violation of the compact, hastened to the American camp. Being shortly after taken prisoner by the English, he was tried and hanged. Consult Anon., 'Col. Isaac Hayne' (in *Historical Magazine*, Vol. XII, p. 76, 1867); Lee, Henry, 'Memoirs of the War in the Southern Department of the United States' (new ed., New York 1869); Ramsay, D., 'The History of South Carolina, 1670–1808' (Charleston 1809).

HAYNE, Paul Hamilton, American poet: b. Charleston, S. C., 1 Jan. 1830; d. Grovetown, Ga., 6 July 1886. He was a nephew of R. Y. Hayne (q.v.) and was educated at the Charleston College, studied law and engaged in journalism. He served in the Confederate army till forced to resign on account of ill health, and lost nearly all his property through the bombardment of Charleston and the subsequent pillage. With the little left to him he retired to Copse Hill, Grovetown, Ga., where he spent the rest of his life, a partial invalid. His verse is marked by grace and melody and he ranks almost the first among distinctively southern poets. He published 'Poems' (1855); 'Sonnets and Other Poems' (1857); 'Legends and Lyrics' (1872); etc. A complete edition of his poems appeared in 1882.

HAYNE, Robert Young, American statesman: b. Colleton District, S. C., 10 Nov. 1791; d. Asheville, N. C., 24 Sept. 1839. After studying law he was admitted to the bar in 1812; and served in the second war with Great Britain, returning at its close to his practice in Charleston. He was a member of the State legislature 1814–18, and became Speaker, was attorney-general of the State in 1818–22, and a United States senator 1823–32. He vigorously opposed protection, and in 1832 boldly supported in Congress the doctrine of nullification. Daniel Webster's reply to Hayne upon this theme is classed among the former's ablest speeches. In November 1832 South Carolina adopted an ordinance of nullification, in December Hayne was elected governor, and the State prepared to resist the Federal power by force of arms. A compromise, however, was agreed to, and the ordinance was repealed. Hayne was mayor of Charleston in 1834.

HAYNE, William Hamilton, American poet: b. Charleston, S. C., 11 March 1856. He is the son of Paul Hamilton Hayne (q.v.). He received a secondary education, from 1879 contributed extensively to various periodicals, and published 'Sylvan Lyrics and Other Verses' (1892).

HAYNES, hānz, **Arthur Edwin,** American mathematician: b. Van Buren, N. Y., 23 May 1849; d. 12 March 1915. After graduation from Hillsdale College, Mich., in 1875 became instructor of mathematics and physics there in the same year; and was professor, 1877–90. He held the same position in Michigan Mining Schools in 1890–93, and was assistant professor of mathematics at the University of Minnesota, 1893–96, in its engineering department 1896–1901, and professor of engineering mathematics 1901–12. He has published 'The Desirability of Uniformity in the Use of Mathematical Symbols and Terms'; etc.

HAYNES, hānz, **Elwood,** American inventor: b. Portland, Ind., 14 Oct. 1857. He was graduated at the Worcester Polytechnic Institute in 1881 and in 1884–85 took a postgraduate course at the University of Johns Hopkins, Baltimore, Md. He was employed as science teacher at the Eastern Indiana Normal School, Portland, Ind., in 1885–86 and for the following four years was manager of the Portland Natural Gas and Oil Company. From 1890 to 1901 he was field superintendent of the Indiana Natural Gas and Oil Company since 1898. In 1881 he discovered tungsten chrome steel; in 1899 an alloy of nickel and chromium, and shortly afterward an alloy of cobalt and chromium. The last named alloy was developed by him in 1910 to make it suitable for cutting instruments and the business of its manufacture as a commercial product grew rapidly. In 1893–94 Mr. Haynes designed and constructed a horseless carriage, which is the oldest American automobile in existence and is now on exhibition at the Smithsonian Institution, Washington, D. C. In 1895 he introduced aluminum in automobile construction and in 1903 invented and constructed the rotary valve gas engine. In 1911 alloys of cobalt, chromium and tungsten, and of cobalt, chromium and molybdenum were discovered by Mr. Haynes. He is president of the Haynes Stellite Company which since 1912 has been engaged in the manufacture of tools from this material. He is a member of the American Chemical Society, the Society of Automobile Engineers and of the Iron and Steel Institute of London, England. In 1912 he was a member of the organizing committee of the Eighth International Congress of Applied Chemistry, at New York and Washington.

HAYNES, John, American colonial governor: b. Old Holt, Essex, England; d. Hartford, Conn., 1 March 1654. He came with Hooker and his company to Boston in 1633, was soon after chosen assistant, and in 1635 governor of Massachusetts. In 1636 he removed to Connecticut, being one of the prominent founders of that colony. In 1639 he was chosen its first governor, and every alternate year afterward, which was as often as the constitution permitted, till his death. He was one of the five who in 1638 drew up a written constitution for the colony, which was finished in 1639, the first ever formed in America, and which embodies the main points of all our subsequent State constitutions, and of the Federal constitution.

HAYS, Isaac, American physician and editor: b. Philadelphia, 5 July 1796; d. there, 12 April 1879. He was graduated from the University of Pennsylvania in 1816 and from its medical school in 1820. In addition to his long service as general practitioner he was for 52 years on the staff of the ‹American Journal of the Medical Service.› In 1843 he established a monthly, the *Medical News,* and in 1874 the *Monthly Abstract of Medical Science.* He edited ‹Wilson's American Ornithology› (1828); ‹Hoblyn's Dictionary of Medical Terms› (1846); ‹Lawrence on Diseases of the Eye› (1847); and ‹Arnott's Elements of Physics› (1848). He was president of the Philadelphia Academy of Natural Sciences (1865–69).

HAYS, Willet Martin, American agriculturist and plant breeder: b. Hardin County, Iowa, 19 Oct. 1859. He received his academic education in Oskaloosa College, after which he spent one year in Drake University. He graduated from the Iowa State College of Agriculture in 1885. He was made an assistant in Agriculture in the Iowa State College in 1886, and became associate editor of the *Prairie Farmer,* at Chicago, in 1887. He then entered the service of the Agricultural College and Experiment Station of the University of Minnesota, where he was engaged from 1888 to 1891, when he resigned to accept a position as professor of agriculture and agriculturist of the experiment station at the North Dakota Agricultural College. This position he left to accept a similar position at the University of Minnesota, which he held until the end of 1904, when he was appointed assistant secretary of Agriculture at Washington. During the course of his service with the Minnesota Agricultural Experiment Station, he perfected and published methods of breeding and producing new varieties of wheat, corn, flax, alfalfa and other field crops, which have been adopted and widely used by seed-breeding specialists in this country and abroad. He also produced and introduced several new and valuable varieties of wheat. He organized and served as the secretary of the Minnesota Field Crop Breeders' Association, and was the organizer and first secretary of the American Breeders' Association and was the editor of its annual report. He is the author of a number of books, including ‹Plant Breeding,› ‹Variation in Cross-Bred Wheats,› ‹Agricultural Industries and Home Economics,› ‹Breeding Plants and Animals,› ‹Education for Country Life,› ‹Farm Development,› and is co-author (with Edward C. Parker) of ‹The Cost of Producing Farm Products.› He served as Assistant Secretary of Agriculture from January 1905, to March 1913.

HAYS, William Jacob, American painter: b. New York, 8 Aug. 1830; d. there, 13 March 1875. He studied art under John Rubens Smith, and his ‹Dogs in a Field,› exhibited in the Academy of Design in 1850, won him the reputation of an animal painter of remarkable fidelity to nature and spirit in design. He studied the bison in the upper waters of the Missouri and the deer in Nova Scotia. His ‹Bison Bull at Bay› and ‹Herd of Caribou in Nova Scotia› are characteristic pictures.

HAYS, William Shakespeare, American song-writer and composer: b. Louisville, Ky., 19 July 1837; d. 23 July 1907. In 1857 he became a reporter for the Louisville *Democrat,* subsequently was clerk and captain of steamboats on the Ohio and Mississippi, and became marine editor of the Louisville *Courier Journal* and *Times.* He wrote and composed more than 300 songs, among them ‹Nora O'Neil,› ‹Molly Darling,› ‹Write Me a Letter from Home,› ‹The Little Old Cabin› and ‹Shamus O'Brien›; published ‹Poems and Songs› and claimed to be the author of ‹Dixie.› His songs sold very extensively.

HAYS, Kan., city, county-seat of Ellis County; on Big Creek, and on the Union Pacific Railroad; about 222 miles west of Topeka. It is in a fertile agricultural region. The chief manufactures are flour, dairy products and machinery. It has grain-elevators, flour mills, machine shops, etc., and there are large annual shipments of grain, flour and live stock. It is the seat of a Normal school and of a State agricultural experiment station. The experiment station is connected with the State Agricultural College, which owns near Hays 2,000 acres of land. The waterworks are municipally owned. Pop. 1,961.

HAYTI. See Haiti.

HAYWARD (properly "haw-ward," keeper of the haws or hedges, and still no pronounced, or rather as "howard," in country districts; the family name Howard as well as Hayward is from this), a town officer in old New England, whose duty was to keep the cattle on the roads from breaking through the hedges or fences into enclosed grounds and to impound them if they did so. The title came to be generic for a cattle-ward, and the hog-reeve was frequently known as a "hog howard."

HAYWARD, Wis., town, county-seat of Sawyer County; on the Namakagon River, and on the Chicago, Saint Paul, Minneapolis and Omaha railroads; about 63 miles by rail southwest of Ashland. It is in the vicinity of the lumber region of the State, and the chief industry is lumbering. Agriculture is also important and it contains a flour and feed mill, a pickle factory, and a creamery. The water system is the property of the town. It has a government Indian school and a public library. Pop. 2,869.

HAYWOOD, Marshall DeLancey, American author: b. Raleigh, N. C., 6 March 1871. He was educated at the Raleigh Academy and at Johns Hopkins University. Since 1901 he has served as librarian of the North Carolina Agricultural and Mechanical College, librarian of the State library at Raleigh and editor of the 'Biographical History of North Carolina.' He is a member of numerous historical societies, and has written several books, among them 'Governor William Tryon and His Administration in the Province of North Carolina' (1903); 'Freemasonry in North Carolina and Tennessee' (1906); and 'The Mecklenburg Declaration'; 'Lives of the Bishops of North Carolina' (1910); 'Ballads of Courageous Carolinians' (1914).

HAZAEL, hā'zēel, king of Damascus, who ruled about 850 B.C. The story of his elevation to the throne according to the prophecy of Elisha is contained in II Kings viii, 7–15. He was successful in his struggle to keep Ramoth-Gilead from his enemies, Joram of Israel and Ahaziah of Judah; and wrested all of the trans-Jordanic provinces of Israel from Joram's successor, Jehu. Hazael's attacks against Judah were abandoned at the presentation of tribute from King Jehoahaz. He was succeeded by his son Benhadad.

HAZARD, Caroline, American college president: b. Peacedale, R. I., 10 June 1856. She was educated in Providence and in Europe, and in 1899 was appointed president of Wellesley College, Mass., receiving the degrees of M.A. and Litt.D. from the University of Michigan and Brown University the same year. She is a granddaughter of R. G. Hazard (q.v.) and has published 'The Narragansett Friends' Meeting in the 18th Century' (1899); 'Thomas Hazard: a Study of Life in Narragansett in the 18th Century' (1893); 'Some Ideals in the Education of Women' (1900); 'A Scallop Shell of Quiet' (1908); 'The College Year' (1910).

HAZARD, Ebenezer, American author: b. Philadelphia, 15 Jan. 1744; d. there, 13 June 1817. He was graduated from Princeton in 1762, in 1782–89 was postmaster-general, and from 1791 was in business in Philadelphia, where he assisted in the establishment of the North American Insurance Company. He published 'Historical Collections' (1792–94) and 'Remarks on a Report Concerning Western Indians.'

HAZARD, Rowland Gibson, American manufacturer and philosopher: b. South Kingston, R. I., 9 Oct. 1801; d. Peacedale, R. I., 24 June 1888. He was a successful business man, being long engaged in the woolen manufacture in Peacedale. He also wrote on philosophical subjects; his works including 'Language, its Connection with the Constitution and Prospects of Man' (1836); 'Essays on the Resources of the United States' (1864); 'Causation and Freedom of Willing' (1869).

HAZE, a condition of the atmosphere which deadens the blueness of the sky and obscures the sharp outlines of distant objects. Haze is due to fine dust in the air or to extreme heat, the latter being known as heat-haze. In certain parts of China the haze is like a thin fog. Extensive forest fires create a smoke-haze, of a dense blue color, which drifts like rain clouds hundreds of miles from the scene of the fire. Volcanic eruptions throw fine dust into the air in enormous quantities, forming a haze which is carried many hundreds of miles. See DUST.

HAZELNUT, or FILBERT, a genus (*Corylus*) of shrubs and trees of the family *Betulaceæ*, confined to the northern hemisphere. The male flowers are in long cylindrical aments or catkins; and the fruit, a nut, is marked at its base with a large cicatrix. The inflorescences of the hazel are developed in the year preceding their appearance; the male flowers last over the winter, naked; the female inflorescence is enclosed in a bud. In early spring the male catkins elongate and produce an abundance of dry pollen, while the female inflorescences are distinguishable from the leaf buds only by their larger size and projecting red stigmas. The nut is enveloped at the base by a sheath of succulent bracts.

The European hazel (*C. avellana*), from cultivation has produced several varieties, differing in the size, shape and flavor of the nuts, which are commonly known under the name of filberts. It grows in all situations and is easily cultivated, but a light and tolerably dry soil is the most suitable. The best nuts come from Spain, where they are baked in large ovens before export, in order to ensure their preservation. Other species occur in southern Europe and Asia. The American hazel (*C. americana*) very much resembles the European, but is lower in stature. It is common in most parts of the eastern United States, but has not been cultivated. A second species (*C. rostrata*) also occurs in eastern North America and a third is found in California.

The oil which is obtained from hazelnuts by pressure is little inferior in flavor to that of almonds, and chemists employ it as the basis of fragrant oils artificially prepared and used by perfumers, because it easily combines with and retains odors. In many parts of England hazels are planted in coppices and hedge-rows for several useful purposes, but particularly to be cut down periodically for charcoal, poles, fishing-rods, etc. In brewing, the dried twigs were used as a substitute for yeast when they were soaked in fermenting liquor. Being extremely tough and flexible, the branches are used for making hurdles, crates and springles to fasten down thatch. They are formed into spars, handles for implements of husbandry, and when split are bent into hoops for casks. Charcoal made from hazel is much in request for forges, and when prepared in a particular manner is used by painters and engravers to draw their outlines. The roots are used by cabinetmakers for veneering; and in Italy the chips of hazel are sometimes put into turbid wine for the purpose of fining it. Finally forked twigs of the European hazel were formerly used by diviners to determine the position of water, gold, etc.

HAZELTINE, hā'zĕl-tĭn, **Mayo Williamson,** American journalist and literary critic: b. Boston, Mass., 24 April 1841; d. Atlantic City, N. J., 14 Sept. 1909. He graduated from Harvard, studied also at Oxford, practised law until 1878 and was then appointed literary editor of the New York *Sun*. He became widely known as a critic for his reviews in the *Sun*, and has published in book form ‘Chats about Books’ (1883); ‘British and American Education’; ‘The American Women in Europe.’

HAZEN, Charles Downer, American college professor: b. Barnet, Vt., 17 March 1868. Studied at Dartmouth and the universities of Göttingen, Berlin and Paris, and returned to take his Ph.D. in Johns Hopkins in 1893. He was head of the department of history in Smith College (1894–1914); lecturer in Columbia University (1910–11) and in Johns Hopkins (1915–16). He is author of ‘Contemporary American Opinion of the French Revolution’ (1897); ‘Old Northampton’ (1904); ‘Europe Since 1815’ (1910); ‘Modern European History’ (1916). He has also written for scientific periodicals and is co-author of ‘Historical Sources in Schools.’ ‘Alsace-Lorraine under German Rule’ appeared in 1917.

HAZEN, John Douglas, Canadian statesman: b. Oromocto, N. B., 5 June 1860. He is a graduate of the University of New Brunswick and was called to the bar in 1883. He represented Saint John city and county in the House of Commons 1891–96; was elected to and became leader of the opposition in the local legislature in 1899, and premier 1908–11. In 1911 he re-entered the House of Commons and in that year was appointed Minister of Marine and Fisheries in the Borden administration.

HAZEN, William Babcock, American soldier: b. West Hartford, Vt., 27 Sept. 1830; d. Washington, D. C., 16 Jan. 1887. He was graduated at West Point in 1855, went to the front in the Civil War in command of 41st regiment of Ohio Volunteers, which he himself had recruited in 1861, served actively in Ohio, Kentucky and through the Atlanta campaign and in Sherman's march through Georgia, and in 1865 took command of the 15th army corps. He observed the Franco-Prussian War on French territory and was at Vienna as military attaché to the United States legation during the Turko-Russian War. Appointed chief signal officer in 1880, with the rank of brigadier-general, he employed scientists as observers, introduced «cold-wave» signals and suggested the standard-time meridians at present in use. He published ‘The School and the Army in Germany and France, with a Diary of Siege Life at Versailles’ (1872); ‘Our Barren Lands’ (1875); and ‘A Narrative of Military Career’ (1885).

HAZLETON, hā'zĕl-tŏn, Pa., city situated in Luzerne County, on the Pennsylvania and the Lehigh Valley railroads, about 24 miles south of Wilkes-Barre. The city was settled in 1820, incorporated as a borough in 1840 and chartered as a city in 1890. It occupies a picturesque site at an elevation of 1,700 feet and is popular as a summer resort. It is situated in the anthracite coal region and its industrial interests are largely connected with the mining and shipping of coal. Its chief manufactures are foundry and machine-shop products, carriages, paper boxes, shirts, underwear, lumber, beer, baking-pans, cattle-powder, cigars, coffins and caskets. It has knitting mills, silk mills, three daily and eight weekly newspapers. It contains a State hospital for miners, 30 churches, a city hall, Hazel Park, a summer resort, United Charities Home, three banks, a convent, high school and Saint Gabriel's Academy. Hazleton adopted the commission form of government in 1913. Pop. 27,511.

HAZLITT, hăz'lĭt, **William,** English critic and essayist: b. Maidstone, Kent, 10 April 1778; d. Westminster, 18 Sept. 1830. His father, a friend of Benjamin Franklin, was a Unitarian minister, and with his family was in the United States 1783–87, locating at Philadelphia and Boston. In 1793 William became a student in the Unitarian College at Hackney. He devoted more time, however, to literature and art than to theology, and upon leaving college resolved to become a painter. He painted portraits with only tolerable success and finally renounced art, and in 1805 opened his literary career with an essay ‘On the Principles of Human Action,’ in which much metaphysical acumen was displayed. In 1811 he settled in London, deriving his principal support from his contributions of political articles and theatrical and art criticisms to the newspapers, and his occasional lectures and publications. In 1813 he delivered at the Russell Institution a course of lectures on «English Philosophy,» and subsequently delivered courses of lectures on the English poets generally, the comic poets and the Elizabethan poets. Later in life he contributed to the *Edinburgh Review* and some smaller magazines. He was a good art critic, but his tendency to prejudice and paradox, and his almost contemptuous regard for the productions of contemporary genius, render him a less safe authority than his knowledge and talents would lead us to expect. It is said of him that he never altered an opinion after he had reached the age of 16, and never read any book through after the age of 30. It is as a literary critic and essayist that Hazlitt achieved his chief success. Saintsbury has said that «long before Sainte-Beuve, Hazlitt had shown a genius for real criticism.» He has probably not been surpassed by any English critic. Yet his recognition, in view of this fact, has been singularly inadequate to his merits. His judgment was, it is true, often marred by prejudice and by his paradoxes. But in the main it was discriminating and duly appreciative. His equipment might not now be thought adequate, but it was almost certainly in most respects superior to that of his Georgian contemporaries. He was able to write interestingly of a wide range of topics. He was bitterly attacked, after the custom of the times, by writers, particularly journalists, of adverse political views. But as a controversialist he was more than the equal of any of these, bold in epigram and invective. His style has been highly praised for its combination of vigor and ease, its rhythm, its clearness and the aptness of its epithets. Not only in critical analysis but as well in narrative and description it is excellent. Hazlitt lectured in 1818–21 at the Surrey Institute. Northcote states that had he continued his art work he would have become a great painter. The best of his essays for the *Examiner* appeared in 1817 under the title 'The Round Table.' The 'Spirit of the Age, or Contemporary Portraits,' also a significant work and by some critics considered his best, was published in 1825. Further essays are grouped in 'The Plain Dealer' and 'Sketches and Essays.' Among other well-known works of Hazlitt are 'Characters of Shakspere's Plays' (1817); 'A View of the English Stage' (1818); 'Lectures on the English Poets' (1818); 'Lectures on the English Comic Writers' (1819); 'Lectures on the Elizabethan Age' (1821); 'Life of Napoleon Bonaparte' (4 vols., 1828). There is an edition of the 'Works' with an introduction by Henley (1902), and a 'Life' by Augustine Birrell (1902). Consult also the 'Memoirs,' by W. Carew Hazlitt (1867), and Saintsbury, 'Essays in English Literature' (1890); 'History of Criticism' (1900).

HAZLITT, William Carew, English author: b. London, 22 Aug. 1834; d. 8 Sept. 1913. He is a grandson of William Hazlitt (q.v.). He was at first a civil engineer, relinquished that profession for journalism and finally took up that of literature. Among his numerous works are 'History of the Venetian Republic' (1860); 'Memoirs of William Hazlitt' (1867); 'Bibliographical Collections and Notes' (1876–92); Letters of Charles Lamb' (1886); 'Four Generations of a Literary Family' (1897); 'Leisure Intervals,' poems (1897); 'Coins of Europe' (1893–97); 'Lamb and Hazlitt' (1900); 'Shakespeare: the Man and His Work' (1908); 'Faiths and Folklore' (1905); 'Some Prose Writings' (1906); 'A Roll of Honour' (1908).

HAZOR, or **CHAZOR** (Heb., enclosure), the name of several places in ancient Palestine, the best known of which was the seat of Jabin, a Canaanitish king of considerable power, who, with his allies, was defeated by Joshua (Josh. xi, 1–13). Though it recovered and oppressed Israel, it was conquered a second time by Barak (Judges iv) and remained in the possession of Israel until the invasion of Tiglath-pileser. Solomon made it a northern frontier fortress (1 Kings ix, 15). Its site has been variously placed. Consult Hastings' 'Dictionary of the Bible' (1899).

HAZZARD, David, American politician and jurist: b. Broadkiln Neck, Sussex County, Del., 18 May 1781; d. 8 July 1864. He served as an ensign in the War of 1812, was elected governor on the American Republican ticket in 1829, and subsequently was State senator and an associate judge. During his administration as governor, a constitutional convention was held at Dover, Del., by which, among various revisions, the governor's term was changed from three to four years. Hazzard was a member of the Constitutional Convention of 1852.

HEAD, Barclay Vincent, English numismatic scholar: b. Ipswich, Suffolk, 2 Jan. 1844; d. 12 June 1914. In 1864 he became an assistant in the British Museum, where in 1893 he was made keeper of the department of coins and medals. He was also appointed joint-editor of the *Numismatic Chronicle*. His chief work is the 'Historia Nummorum' (1887), a valuable study, and the standard one in its department. Among further publications by him are 'History of the Coinage of Bœotia' (1881), and 'Guide to the Coins of the Ancients' (1881).

HEAD, Sir Edmund Walker, English colonial administrator and author: b. near Maidstone, Kent, 1805; d. London, 28 Jan. 1868. He was educated at Oriel College, Oxford, became a Fellow of Merton, studied law, was a poor-law commissioner in 1841, and in 1847–54 lieutenant-governor of New Brunswick. From 1854 to his retirement in 1861 he was governor-in-chief of Canada. During his administration the seigniorial tenures (see Canada — Seigniorial Tenure) and the clergy reserves (see Canada — The Clergy Reserves) were abolished. He was afterward governor of the Hudson's Bay Company. He was an art critic of some importance, and published a 'Handbook of Painting of the German, Dutch, Spanish and French Schools' (1848), and other works. His poetical contributions to *Fraser's Magazine* appeared in 1868 in book-form.

HEAD, Sir Francis Bond, English colonial administrator and author: b. near Rochester, Kent, 1 Jan. 1793; d. Croydon, Surrey, 20 July 1875. Educated at Woolwich, he became first lieutenant of engineers in 1811, was at Waterloo and at Fleurus, retired from the army in 1825, and went to South America as a prospector in gold and silver mines. Of some of his experiences there he gave an account in 'Rough Notes of a Journey in the Pampas and Andes' (1828). In 1836 he was appointed lieutenant-governor of Upper Canada. His administration was a decidedly unfortunate one. Unfamiliar with the political status of the country, he opposed the union of the provinces, and endeavored to conduct the government without the assistance of a council. This state of affairs may be regarded as the chief cause for the part taken by Upper Canada in the insurrection of 1837. He was recalled in 1838. His numerous publications include 'Bubbles from the Brunnen of Nassau' (1833); 'The Defenceless State of Great Britain' (1850); 'The Horse and His Rider' (1860); 'The Royal Engineer' (1869).

HEAD, Sir George, English writer of travels, etc.: b. Higham Parish, Kent, 1782; d. 1855. He held various posts in the army, and was present at most of the great battles of the Peninsula. In 1814 he proceeded to Canada to be chief of the commissariat of a proposed navy on the Canadian lakes, and subsequently published his experiences in 'Memoirs of an Assistant Commissary-General' and 'Forest Scenes and Incidents in the Wilds of North America.' He was knighted in 1831. He also wrote 'Rome, a Tour of Many Days'; 'A Home Tour Through the Manufacturing Districts of England,' and 'A Tour Through

Various Parts of the United Kingdom' and other works.

HEAD, Natt, American politician: b. Hookset, N. H., 20 May 1828; d. there, 12 Nov. 1883. He became a railroad and general building contractor, sat in the State legislatures of 1861 and 1862, was adjutant-general of the State in 1864-70, and in that capacity published a four-volume military record of New Hampshire during the Civil War. In 1876 and 1877 he was elected to the State senate and in the latter year was its president. He was governor in 1879-80.

HEAD, the anterior or front part of the body of an animal when it is marked off by a difference in size, or by a constriction. The presence or absence of a head was formerly much used as a character in classification. But this line of classification is artificial. The mouth and principal nervous organs are the guides to the anterior end of the body, where the head, when recognizable, is situated. In the protozoa, infusoria and cœlenterates, such as the hydra and corals, there is no nervous ganglion, and the mouth is not surrounded by special structures. In the inferior worms the front end becomes marked by the presence of ganglia. The so-called head of parasitic animals, such as the tapeworms, is only the end of attachment, but neither mouth nor ganglia exist in it. In the polyzoa, lampshells, ascidians, and lamellibranch mollusks mouth and ganglia exist, but they are not surrounded by special structures. But in the worms proper, the articulated animals, the land and fresh-water gasteropods and the cuttlefishes a head proper is found. That is, the mouth and the anterior nervous ganglia are placed in a segment of the body which, by structure, is different from the rest. Thus in the worms and articulated animals some of the rings or articles of which the body is made up are fused together, the appendages being not walking limbs, but modified into jaws or jawlike organs. Thus the common shore-worms possess a structural head, though it is not apparent. The head is first best defined in the insects. The snail's head has its cavity shut off by a diaphragm from the rest of the body cavity. The cuttlefishes have, in addition, a remarkable cartilaginous box, which like a skull, protects the ganglia and gives support to the muscles. The head of the vertebrated animals presents a regular series of increasing complexity from the amphioxus upward. In that fish the most anterior part of the nervous cord is lodged in a canal scarcely distinct from that which contains the rest of it. Ascending in the series, it becomes evident that as the anterior nervous mass enlarges, and its ganglia increase in complexity, the anterior vertebræ change their character; as the brain becomes specialized, so does the brain-case or skull. In man the brain attains its highest development and the head its greatest complexity, the difference between skull and face being now most pronounced. The vertebrate theory of the skull, first propounded by Goethe, is now accepted to this extent, that the skull or cranium consists of three vertebræ, which are recognizable in the fish, and that the facial bones are not vertebræ, but developed from cartilage which did not form an original part of the vertebral column. A vertebræ consists of a body or centre, from which two processes arch upward and close in the spinal canal with its contents, the spinal cord. The posterior cranial vertebræ is the occipital, consisting of a centre, two lateral pieces, and a superior, the next is the parietal, of which the basisphenoid is the centre, and the great wings of the sphenoid and the parietals the lateral arches; the most anterior is the frontal, with its centre, the presphenoid, and its arch, formed by the orbital plates of the sphenoid and the frontals. The centres of the spinal vertebræ are ossifications around a fibrocartilaginous rod, the *chorda dorsalis,* which ends in the basisphenoid. So far spinal column and skull have a common base; but the spinal vertebræ were preceded by and are in fact modifications of primitive vertebræ, and no representatives of these appear in the development of the skull. It is therefore open to question whether the three divisions just mentioned are really vertebræ, or should not rather be called cranial segments. There is the more reason for this that in fishes the basisphenoid and presphenoid are represented by a single bone, the parasphenoid, which underlies the skull, but disappears in the higher vertebrates, and that the presphenoid is not properly connected with the chorda dorsalis, but rather belongs to the series of facial bones. The pituitary body which projects from the lower surface of the brain lies in front of the end of the chorda dorsalis: from the latter rod and its surroundings a plate of cartilage passes forward on either side of the pituitary body, and these (the *trabeculæ*), meeting in front of that body, form the cartilaginous axis around which the vomer, ethmoid, and other facial bones are developed, while the presphenoid is an ossification in this axis just where the two portions meet in front of the pituitary. The sense organs, the ear and the eye, are, so to speak, lodged in capsules of bone which are inserted, the ear between the occipital and parietal, the eye between the parietal and frontal segments. They are accidental, not essential parts of the cranium. The hyoid apparatus and the lower and upper jaws are

DIAGRAM, ILLUSTRATING GOETHE'S THEORY OF THE VERTEBRATE HEAD.

NASAL.	FRONTAL.		PARIETAL.		OCCIPITAL.	
Nose. Ethmoid and Prefrontal.	Frontals. Orbitosphenoids.	EYE.	Parietals. Alisphenoids.	EAR.	Supraoccipital. Exoccipitals.	*Arches.*
		Pituitary.				
Vomer.	Presphenoid.		Basisphenoid. Parasphenoid.		Basioccipital.	*Centra.*
Upper jaw. *Mouth.* Lower jaw.		Suspensorium.		Hyoid.		

developed from the cartilaginous walls of the embryonic skull, and the jaws come in a secondary manner to take part in the composition of the face. (See Respiratory Organs). The increasingly globular form of skull in the vertebrates is due to the greater increase of the cerebral hemispheres relatively to that of the base of the brain and axis of the skull; hence the brain comes in man to overhang the face. Of course it is to be remembered that while in the vertebrated animals the head is divided by its axis (commencing at the middle line of the upper jaw and passing backward through the basisphenoid to the vertebral centres) into an upper chamber, lodging the brain, and a lower, lodging the first part of the alimentary canal, in the lower animals the cavity is a single one, the œsophagus piercing the nervous system so as to reach the surface of the body, and thus coming to be surrounded by a pair of ganglia above and a pair below, with the filaments connecting these ganglia. In the vertebrate the head is curved downward, the basisphenoid being the pivot point, so that the mouth is pushed to the lower surface; in the lower animals the under surface of the body curves upward, so as to carry a part of the nervous system past the mouth toward the upper surface. The eyes and feelers of a crab are in fact modified limbs which are thus carried upward; the jaws and sense organs of a vertebrate are entirely distinct from the limbs and other appendages of the trunk.

HEAD-HUNTING. See Dyaks.

HEAD MONEY, an immigration tax of 50 cents levied by act of Congress 3 Aug. 1882 on every foreigner brought to the United States. Before the passage of this act the State of New York levied a "head tax" on all immigrants arriving at New York, the funds going to the support of the State board of immigration. A test of the legality of the tax being made in the courts, a decision was rendered that the New York statute was void because it infringed on the prerogatives of national government. Subsequently the act of Congress imposing the tax was questioned in the United States Supreme Court, and a decision affirming the constitutionality of the law was made. The national act provides that the tax shall be paid by the master or owner of the vessel bringing the immigrants, to the collector of the port, and by him turned over to the treasury of the United States, to be used by the secretary to defray the expenses of regulating immigration and to relieve immigrants in distress. The tax was increased to $2 per head in 1903, and by act of 20 Feb. 1907, amended 26 March 1910, was again increased to $4 per head. See Immigration.

HEADACHES, or pains in the head, arise from a multiplicity of causes. In general they may be divided into two great groups: Those due to changes in tension within the brain, largely brought about by changes in the blood-vessels. Sick headache — so-called congestive headache — or they are really not headaches, but various forms of pain about the head and face — neuralgias of various kinds. Headaches are for the most part of the first variety and are related to changes in the vascularity of the brain structures, which blood-vessel changes result from a complicated series of events. The simplest are the headaches due to blood-vessels' reactions to infections. These infections may be of various kinds — influenza, measles, typhoid, malaria, etc. The general systemic reaction, as recorded in the brain structures, serves as a notice to consciousness through pain that something is wrong. Quiet is enforced and attention intelligently directed toward finding the faulty function. These headaches are usually self-limited. When the infection involves the brain or meningeal structures then various forms of meningitis arise with their own special type of headache. (See Meningitis). Emotional disturbances, however, are the most frequent cause for headaches. Nearly all of the headaches called stomach or intestinal are in reality emotional. The reaction to the emotions — often unconscious, and taking place during the night life even, and often headaches are present on awakening in the morning — is to bring about states of altered pressure within the brain, which are registered as headaches. This form of emotional headache may be thought of as a scapegoat, a bodily carrier for faulty management of unconscious wishes. Similar headaches from pressure of organs within the brain are not infrequent. Thus in growing adolescents, pituitary pressure may cause severe headaches. With enlargement of the sella turcica such headaches may clear up. In certain types of kidney disturbance, severe headaches occur also. Anæmia is mainly the cause here. Poisoning from withheld products healthfully eliminated by the kidneys may also account for some of these. Consult Forscheimer's 'Therapeutics'—*Treatment of Headaches.*

HEADLEY, hĕd'lĭ, **Joel Tyler,** American historian: b. Walton, N. Y., 30 Dec. 1813; d. Newburg, N. Y., 16 Jan. 1897. Graduated from Union College in 1846, he took a course in theology at the Auburn Seminary, was pastor at Stockbridge, Mass., and in 1846 became assistant editor of the New York *Tribune.* In 1856–57 he was secretary of State for New York. His works, written in a popular vein, had great currency in their day, and include 'Napoleon and his Marshals' (1846); 'Washington and his Generals' (1847); 'The Adirondacks' (1849), said to be the first book to advocate that region as a health-resort; 'Grant and Sherman, their Campaigns and Generals' (1865); 'The Great Rebellion' (1864), and other works on that subject.

HEADLEY, Phineas Camp, American Congregational clergyman: b. Walton, N. Y., 24 June 1819; d. Lexington, Mass., 1903. He was a brother of J. T. Headley, the historian (q.v.). He was admitted to practise at the bar in 1847, but studied theology at Auburn Seminary, held pastorates in various Presbyterian and Congregational churches, and contributed to the New York *Observer* and *Tribune,* and many other newspapers and magazines. Among his works are 'Women of the Bible' (1850); biographies of the Empress Josephine (1851), Kossuth (1852), Lafayette (1853), Mary, Queen of Scots (1856), Ericsson (1863), Farragut (1864), and others; 'Half-Hours in Bible Lands' (1867); 'Court and Camp of David' (1868); and 'Public Men of To-day' (1882).

HEALTH, Public, Regulation of, supervision, protective and preventive work throughout the nation, carried on by the United States Public Health Service, a branch of the Treasury Department, under the directorship of a commissioned medical officer, with the title of Surgeon-General. The headquarters is in Washington, D. C. Important achievements of the service are the suppression of yellow fever in the South; the control of bubonic plague in California, Porto Rico and New Orleans; the discovery of an effective method for the prevention and treatment of pellagra; demonstrations of how malaria may be prevented in practically any locality at a comparatively small cost; the establishment of a series of trachoma hospitals and the institution of educational measures to combat the spread of trachoma in the Appalachian Mountains; and the beginning of a nation-wide campaign for the improvement of rural sanitation, which has already resulted in great diminution of disease in the districts where the methods advocated have been applied. On the entry of the United States into the European War the service took charge of the sanitation of extra cantonment zones, co-operating with the military and State and local health authorities in bringing about the elimination of any insanitary conditions which might threaten the health of the military forces and the civilian population. At the Hygienic Laboratory in Washington, technical studies are carried on, and there also are conducted the tests of preparations necessary for the enforcement of the law regulating the sale of biological products in interstate traffic. The Division of Scientific Research supervises field and laboratory investigations of infectious diseases, industrial and school hygiene, rural sanitation, public health administration, coastal waters, shellfish pollution and water supplies and sewage. Field headquarters and laboratories are located at convenient places throughout the country. The Foreign and Insular Quarantine and Immigration Division supervises the 61 quarantine stations in the United States; 26 stations in the insular stations; 89 stations for the medical inspection of immigrants; while, 18 officers are stationed at foreign American consulates to assist in the administration of the quarantine laws and the medical inspection of emigrants. The Division of Domestic (Interstate) Quarantine supervises measures for the prevention of the spread of infectious and contagious diseases in interstate traffic and the administration of the interstate quarantine regulations relating to food and drink furnished passengers on common carriers. It also co-operates with State and local health authorities in the suppression and eradication of such epidemic diseases as plague, cholera, yellow fever typhus fever, smallpox and leprosy. The establishment of a national home for lepers under the administration of the Public Health Service was approved 3 Feb. 1917 and $250,000 appropriated for the purpose.

HEALTH DISTRICT. See DISTRICT.

HEALTH EDUCATION. Health instruction in connection with the schools was inaugurated under the term medical inspection. The original purpose was not to give instruction in health to the children in the schools but to utilize the schools in checking the spread of contagious diseases. The movement was purely voluntary, physicians in leading cities offering their services without compensation. Probably the first country in the world to require action of any kind in the schools of a health character was France. In 1833 that country required the school authorities to keep all schoolhouses in a cleanly condition, and in 1842 provision was made in France by which physicians were required to visit the schools for the purpose of inspecting the children and also to inspect the sanitary conditions of the school buildings.

The next country to give attention to this subject was probably Germany. In 1874 the city of Brussels began the inspection of its school children, and two years later similar action was taken in the cities of Dresden and Leipzig. Later Weisbaden inaugurated a system of inspection. This city gave the subject greater consideration than had yet been given it either in France or Germany. This city inaugurated a very comprehensive system of physical examination of the school children. The plan required examination of the eyes, ears, nose, throat, lungs, spine, heart and skin. In the case of boys an examination was also made for hernia. A definite record was made of each child and this record was revised from year to year throughout the child's school life. The plan required the school authorities to ascertain the height of each child and the weight of each child twice each year and in the case of children who were below normal standards, such additional examinations as might be necessary. When physical defects were discovered in the children, notice was given to the parents and the parents were required to provide remedial treatment. The school authorities provided no treatment whatever for the children.

Other countries instituted a plan of inspection of school children, although not as effectively as France or Germany, as follows: Hungary, 1877; Norway, 1889; Sweden, 1863; Cairo, Egypt, 1882; Chili, 1888; Japan, 1898. A very complete and scientific system has been in existence in the Argentina for several years. England took no definite or effective action in connection with the treatment of children in the schools until 1908. In that year a medical inspection law was enacted which made it compulsory upon the school authorities of England to provide for the medical inspection of all children in attendance upon school.

New York city has the distinction of being the first city in America to inaugurate health inspection of school children. In 1892 that city appointed a medical school inspector. Boston, however, two years later instituted a very effective system of medical inspection. Chicago began this line of work in its schools in 1895, and in 1898 Philadelphia followed. The work has gradually expanded until nearly every State in the Union does more or less work in health instruction among the children in its schools, and 36 of the States have mandatory statutes requiring the physical examination of all children. The work is thoroughly organized in about 800 of the cities of the country, in many of the smaller villages, and even in the rural districts of several States.

The legal right of school authorities to appoint school physicians, school nurses, etc., without direct authority under the statutes has frequently been raised. It is of such vital importance to this subject that the following essential features of an opinion of the Supreme Court of Wisconsin upon the point are given here:

> "Education of a child means much more than merely communicating to it the contents of textbooks. But, even if the term were to be so limited, some discretion must be used by the teacher in determining the amount of study each child is capable of. The physical and mental powers of the individual are so interdependent that no system of education, although designed solely to develop mentality, would be complete which ignored bodily health. And this is peculiarly true of children whose immaturity renders their mental efforts largely dependent upon physical conditions. It seems that the school authorities and teachers, coming directly in contact with the children, should have an accurate knowledge of each child's physical condition, for the benefit of the individual child, for the protection of the other children with reference to communicable diseases and conditions, and to permit an intelligent grading of the pupils. All of these considerations, as well as many others unnecessary to mention, convince us that the conclusions of the learned trial judge were entirely right." State ex rel. Stoltenberg v. Brown, 112 Minn. 371.

There is one other question in this subject fundamental to the whole plan of health instruction which must be considered. The question is frequently raised as to whether the work which has been done in the schools under the name of medical inspection, physical examination, etc., should be under the direction of the health authorities or the school authorities. At first thought it may be considered desirable to have matters which relate to health under the health authorities. The primary purpose of this phase of work in the public schools is now being accomplished through the schools to provide *better educational advancement* for all the children in attendance upon the schools. It is unfortunate that the terminology used in dealing with this subject at the outset was more of a medical character than an educational character. This was due to the fact that the work was first undertaken, as above stated, for the purpose of checking epidemics, etc. In the large cities where this work was first undertaken it was through the health department and in some of such cities the health authorities still continue to supervise such work. The whole trend of thought during the last 10 years, however, and the general policy pursued throughout the country have been to place health instruction under the school authorities and not the health authorities. About 87 per cent of all the work done in this country in relation to the health of children in the schools is directly under the supervision of the school authorities. The United States Commissioner of Education in his annual report in 1915 said:

> "Two gratifying tendencies appear in recent legislative and administrative dealing with medical inspection: The broadening of the scope of medical inspection and the recognition of the educational department as the proper administrative authority. They are interdependent."

Very recently, by an act of Congress, the control of the health work of the schools of the city of Washington was transferred from the board of health of that city to the board of education. In Boston, the second city in the United States to begin this work, the health authorities were responsible for its supervision. Recently the work in that city was transferred from the health department of the city to the board of education.

It is only recently that the educational forces of the country as well as the people generally have begun to appreciate the service which may be rendered in the improvement of our economic and social conditions by providing thorough and scientific health instruction for every child in the country. The subject of health instruction has not been seriously considered as one of the great problems in the administration of the schools which should be attacked by the State itself. Provision has generally been made for the instruction in physiology and hygiene, in sanitation, etc. Medical inspection has been provided in most of the cities and in rural schools. Open-air schools have been established in several of the cities. Physical training has recently come into prominence. Oral hygiene has received only scant attention and the undernourished child has been considered occasionally. Under State authority all of these various phases of health instruction should be co-ordinated and a general program prepared and carried out in detail by all the schools of the State so that the physical development of every child shall receive the same definite consideration that has for years been given to the intellectual development of the child.

A child has no discretion in this country as to whether or not he shall attend school. Neither have the parents of a child discretion in this matter. The American States have very generally declared under mandatory statutes that the interests of the country demand that every boy and girl from 6 to 14 years of age shall be in attendance upon instruction. If suitable instruction is not provided for a child by his parents either at home or in a private school, such child must attend the public school. The State has, therefore, stretched out its strong arm of authority and declared that every child must be in attendance upon school for a certain number of days each year and generally for a period of eight years. If the State imposes this obligation upon the child, is there not the obligation upon the State to see that such child is properly safeguarded in his physical development as well as in his intellectual development?

The results obtained in all parts of the country through medical inspection, the investigations made by leading foundations and other authorities show that more than 50 per cent of all the children enrolled in the schools are below normal physical standards. If all those having defective eyes and defective teeth were included, the percentage would be much larger. The annual report of the War Department for the year 1916 shows that approximately 133,000 men of military age applied during that year for admission to the United States army. These men may naturally be presumed to have been in good physical condition. They were young men of the best physical type to be found in the country. They were required, in accordance with army regulations, to undergo a rigid physical examination prescribed by the government. Approximately 22,000 of these men were ultimately accepted for service in the army and 111,000 were rejected. If the physical standards prescribed by the government for admission to the army before we entered the World War had been strictly adhered to in creating the army for service in France, less than one-third of the enrolled men would have been accepted. Thousands of young men were not admitted to the service until they had received treatment and in many cases operations had been performed to cure physical defects from which they were suffering. After this remedial treatment these men were admitted to the service. There are also thousands of boys and girls in school who have physical defects which interfere with their physical and intellectual development. The great function of the school is so to train and develop boys and girls that when they enter into the activities of the social, commercial and industrial life of the nation they shall possess the best equipment possible for efficient service in their own behalf and in behalf of society in general. One of the greatest assets which a girl or boy may possess when leaving school to become a worker and earner is a sound, healthy body. It is as much the function of the school to teach a boy how to care for his body and to see that proper treatment is provided for physical defects which interfere with his normal growth and development or with his progress in school work as it is to teach such boy how to read and to cultivate in him a desire for wholesome literature. It is for this reason that several of the States have, within the last few years, enacted laws requiring medical inspection and laws requiring physical training in all the schools of the State.

One of the effective agencies in this health movement in the schools is the open-air school. These schools are intended for anæmic children and for those who have a predisposition to tubercular troubles. New York city also has the distinction of having organized the first school of this type. In 1904 the board of education of that city organized an open-air school in connection with the Seaside Home for Children at Coney Island. In the same year a school of this kind was organized in Charlottenburg, a suburb of Berlin. Other schools were organized thereafter in some of the German cities and one was established in London in 1907. The school at Coney Island has been in continuous operation since it was first opened. In 1908 an open-air school was organized at Providence, R. I. Nearly all the leading cities of America now have established in their school systems an open-air school and additional schools of this type are being established in each city in the expectation that all anæmic children and predisposed tubercular children shall ultimately be afforded the advantages offered through this type of school. We have not exact figures on the number of children in the public schools who are tubercular but reliable estimates show that there are at least 100,000 enrolled in the public schools of this country who are in the incipient stages of tuberculosis and that there are more than 100,000 others who have been so exposed to this disease that they should be excluded from attendance in the regular grades of the schools. These 200,000 children should be segregated and provision made for their care and instruction in outdoor or open-air schools. These schools provide the three essentials which are necessary in the proper treatment of tubercular cases, which are fresh air, rest and proper nourishment. In some cities an entire building is set aside for the tubercular children. In other cities the open-air school is built upon the roof of a school building or in one of the upper corner rooms. A school physician or nurse must be supplied, diet must be furnished and the necessary wraps and clothing must be provided.

The best medical authorities of our time say that many diseases such as rheumatism and infections of various organs including the heart, kidneys, appendix, etc., come from foci of infection. A great proportion of the foci are abscesses at the apices of the roots of teeth or pyorrhea pockets about the teeth. Uncleanliness of the mouth causes the teeth to decay, to be broken down and unfit to properly masticate the food. This results in the food not being broken up into small particles nor mixed with the saliva, the first function of digestion. The stomach and other organs of the alimentary canal are thus called upon not only to assume a burden, but must also receive more or less decayed food, pus and germs from the decaying teeth. Thus unclean mouth conditions result in improper assimilation of the food and nutrition of the body and may cause a poisoning or breaking down of the system.

Considering that not more than 15 per cent of the people make any pretense of taking care of the teeth, that fully 80 per cent of all school children have decayed teeth and 20 per cent of them have dental abscesses which are likely to become foci of infection, it is evident that people as a whole have very little conception of the value of proper mouth conditions. It is strictly an educational problem to bring about a better understanding of Oral Hygiene. No child should leave school who has not been taught to take proper care of his teeth and mouth. No system of health instruction will be effective and complete without a dental clinic.

It is known that in many cities and even in other parts of the country children are sent to school who have not had their breakfast. It is also known that large numbers of children are not provided with the kinds of food which afford the nourishment for the proper physical development and growth of children. This too is a subject which is receiving careful attention in the best school systems of the country, and no general plan of health education will rest upon a sound basis which does not take into consideration instruction in nutrition. When the health examination of a pupil shows that such pupil is under-weight, inquiry will be made to ascertain if the child is also under-nourished. The value of food and economy in food should be considered.

On the question of health, the public, the medical profession, the home and the school have not only been too conservative but have been guilty of gross negligence. All of these agencies have possessed false notions of the propriety of the consideration of certain health and physical conditions on which the children of the country should receive sound, direct, discreet, scientific instruction. This failure in the performance of a sacred duty has resulted in shocking conditions which affect the whole social and moral fabric of the nation. The statement is made by reliable authority that the tests made in certain typical States show that of the 10,000,000 men subject to draft, in the enrollment of the War Department, more than

3,000,000 were afflicted with venereal diseases. This condition is a reflection upon our civilization. There should be great satisfaction and encouragement to those who bear responsibility in this matter in the fact that of the more than 2,000,000 American soldiers serving in France less than 1 per cent was afflicted with these diseases. This fact exemplifies the power and influence of scientific instruction, of publicity and of discipline in dealing with this problem. Surgeon General Gorgas of the United States army recently stated that the army suffers a greater loss in service from its men who have venereal diseases than from its men who are wounded. He further stated that in his judgment very little success will be achieved in correcting this evil until the people generally are educated to believe that it is individual action and individual judgment that are finally going to control in establishing proper standards of life in this respect.

All investigations which have been made show that the need for health instruction in rural communities is greater than the need for such instruction in the cities. Dr. Thomas D. Wood, of Columbia University, a leading authority in this country on the subject of health instruction, makes the following statement:

> "It is apparent that, within the last decade, the actual and vaunted physical superiority of country people and children over those living in cities has been reversed, and it is now confidently affirmed that, for the entire population, city dwellers are more healthy than those who dwell in rural districts; city life is more healthy than that of the country. It is just as true, however, and startlingly significant in view of the preceding statements, that most of our best human material for the cities and the nation as well must still come from the country. If rural America is still to be a satisfactory nursery for human life, it must be made healthful and attractive. It must furnish a generous fraction of the best of the population and it must provide conditions favorable for the cultivation of the best."

Health instruction should be given in every schoolroom with the same regularity and definiteness that instruction is given in English or any other subject. The courses of instruction now given in physiology and hygiene should be revised by a competent group of physicians, social hygienists and teachers, and included in the curriculum of every elementary and secondary school in the country under the name of *health* instruction. The examination now improperly called medical inspection or examination or physical examination should be called *health* examination. Every child should look upon a *health* examination as a matter of course and not something unusual in school affairs. The child should expect a *health* examination just as he would expect his history or English examination. The term *health* should be emphasized in every way.

The present system of medical inspection is generally faulty, inefficient and expensive. It will remain so as long as country physicians are employed on a per capita basis in rural schools and part-time physicians are employed in cities. The great bulk of this work should be done by the class-room teacher. No teacher should be graduated from a State normal school, city training school or a training class who has not been trained in her professional course to do the usual health examination work in our schools. No teacher should be licensed to teach who is not qualified to do that work. Special courses should be provided by each State in every city and in suitable centres in supervisory districts where all teachers in the service may be trained to do this work of *health* instruction. What has been said upon health instruction applies to physical training because physical training is a part of and should be included in health instruction. It is just as essential that a person who goes from an institution for the training of teachers, licensed to teach children, shall be educated and trained to give instruction in health matters as it is that such person shall be educated and trained to teach English, numbers, geography or any other subject in the curriculum. There must, of course, be directors and supervisors of health instruction who shall bear the same relation to health instruction that a supervisor of English or drawing bears to the instruction given in such subjects. The directors and supervisors should be trained in our universities for this work. The leading universities of the country should organize courses for the training of men and women for these supervisory positions. Many of these institutions are so located that they have the advantage of schools of education, medical colleges, courses for registered nurses, health departments and local school systems in which health instruction is given. These various agencies should all be brought into harmonious co-operation so that the schools may have the benefit of their knowledge of and experience in these important health problems.

There is no subject which affects more directly and more vitally the happiness, the social welfare, the industrial productivity and the moral fibre of the nation than the health of its people. While this problem is one which has its embarrassments, it is nevertheless one to be attacked by the schools. It is the duty and obligation of the leaders of public education in this country to predicate the health work of the schools upon standards which will develop men and women who are as fit physically for service in times of peace as the government demands its men shall be in times of war.

Health instruction must not only be given but when the physical examination of a child reveals a physical defect or disability which is an impediment to the normal physical or intellectual development of such child, the teacher in charge of such child should immediately notify the parent of such defect or disability. It is then the legal or moral obligation of the parent to provide such remedial treatment as the child needs. The effectiveness of health instruction depends upon following up cases which need treatment. Unless such treatment is provided, the health instruction partially fails in accomplishing the great end which is intended. A parent should not be permitted to fail to discharge an obligation of this character to his child. Remedial relief should not be provided by school authorities if a parent is able to provide it. This phase of public school work, like all other features of public education, should be administered so as to develop self-respect, independence, and a keen sense of personal obligation. These are all elements of the best standard of good citizenship. When it is known to school authorities that a parent is unable financially to provide such treatment as a child requires, the necessary relief should be provided at public expense by the school authorities.

The question may be raised as to the legal right of the school authorities of a city to compel a parent to supply remedial relief to a child who needs treatment and in case of a parent's inability to provide such relief or treatment, the right of the school authorities to supply the same. It is a well-established common-law rule that a parent is lawfully bound to provide for the support of his infant children. In many States the penal law makes it a misdemeanor for a parent to omit wilfully "without lawful excuse, to perform a duty by law imposed upon him to furnish food, clothing, shelter or medical attendance of a minor." If a parent fails or refuses to provide necessary treatment for his child, the school authorities undoubtedly possess the legal power to provide such treatment.

It is as essential to the economic and social interests to make health instruction mandatory in all the schools of the State as it is to make the teaching of English in all the schools of the State mandatory. There are certain fundamental principles which should be followed in the enactment of compulsory health education statutes. These are as follows:

First: Health education is a school question, and the responsibility for the administration of any school proposition should be placed upon the school authorities. Experience has also demonstrated that the administration of any phase of health education, either medical inspection, physical training, or otherwise, by any other agency will result in waste of funds, in the duplication of effort, in the loss of time and energy on the part of pupils and teachers, and in the usual embarrassments and conflict of authority incident to a division of responsibility of the general direction of any one proposition and will, therefore, result in great inefficiency.

Second: A compulsory school statute of any character will be ineffective unless such statute contains a provision which imposes suitable penalties for the violation of such law or for the failure of the officers who administer the law to properly enforce it. A compulsory health instruction statute should, therefore, contain provisions similar to a compulsory attendance statute by imposing a forfeiture of public funds for failure to enforce the law and by providing for the removal of officers who were charged with administering the law, for failure to perform their duty.

Third: School authorities should be given the same power to employ health instructors, directors and supervisors and school nurses which they possess in relation to the employment of teachers.

Fourth: The courses of study for the training of teachers in public schools must contain adequate provision for instruction in health subjects, and as adequate provision must be made by the State for the training of school nurses, school physicians and other school health workers as is now made for the training of teachers.

Fifth. A State bureau should be maintained in every State department of education which shall give general direction to the health work by providing courses of study, formulating plans for the execution of the work, and developing public sentiment which shall give adequate aid and support for health instruction in every community of the State.

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HEALTH INSURANCE. An insurance arrangement for the purpose of providing indemnity for losses sustained because of sickness, these losses being largely of two kinds — loss of earning capacity during the duration of the disease and cost of medical and other aid necessary for recovery. It is known throughout many countries as sickness insurance (Krankenversicherung, L'assurance maladie), but the term "health insurance" was popularized in the United States by the British National Health Insurance Act of 1911, and this term was adopted in 1915 in discussions of this subject in this country. From the point of view of insurance organization three generic forms of health insurance may be recognized: commercial health insurance, mutual health insurance and social health insurance. See SOCIAL INSURANCE.

Commercial health insurance is being sold to an increasing extent by so-called casualty insurance companies in the United States and Great Britain and to some extent on the Continent. It is a comparatively new branch of the private insurance business, grew out of the accident insurance business and is largely written in connection with accident insurance policies. For many years insurance companies were fearful of writing this business because of the assumed difficulty in avoiding malingering. The earlier policies were limited to certain specified diseases, but though such limited contracts are still in the market, they are less popular than insurance against disability due to any disease. The benefits under this form consist of weekly payments of a specified amount for a limited number of weeks, 26 weeks or 52 weeks or even a longer time. Seldom, if ever, do these contracts provide for the furnishing of medical aid or reimbursement for the expenditure for such medical aid.

Mutual Health or Sickness Insurance.— The above described form of commercial health insurance, largely bought by the lower strata of the middle class, occupies only a very small place in the development of health insurance. Mutual health insurance has accomplished very much larger results. Since the continuous possession of good health and the capacity to work is a matter of particularly grave moment to the wage-worker, as compared to other social groups, it is not surprising to find that in most civilized countries the early efforts toward mutual health insurance were made by wage-workers through their manual aid societies. Informal mutual assistance gradually developed into systematic mutual insurance, and largely against the hazards of sickness. Thus developed the strong Krankenkassen of the Germanic countries, the Societés de secours mutuels of France and Belgium, the Societá di Mutuo Soccorso of Italy, the friendly societies of Great Britain and the fraternal orders of the United States. In some countries this development reached very substantial dimensions, especially during the last 50 years. There are millions of members in these societies in France as there were in Great Britain before the introduction of the National Insurance Act of 1911.

Notwithstanding this substantial growth, some definite limitations are recognized to the usefulness and efficiency of this form of sickness or health insurance. The need for sick benefits is greater as one goes down the economic ladder. It was usually found, however, that because of the cost, largely the higher groups of the wage-working class insure while the unskilled, low paid laborer seldom purchases such protection. And because the workmen cannot pay much, the service of these mutual insurance societies is usually meagre and inefficient.

Social health insurance is usually meant even when the shorter term "health insurance" is used, because of the recognition of the great importance of health for the wage-worker or any other person of modest earnings. The social form presupposes some systematic effort of organized society to extend the benefits of health insurance through appropriate action. Simple regulative legislation has been found to have very little effect and can hardly be expected to have any important effect. It is seldom included under social insurance, unless something more substantial is offered by the state or government — either financial subsidies, or the compulsory principle or both.

Existing systems of social health insurance may be divided into two groups — voluntary subsidized insurance in five countries (Denmark, Belgium, France, Sweden and Switzerland) and compulsory health insurance, which until now has been legislated in 10 European countries, chronologically arranged as follows: Germany, 1884; Austria, 1888; Hungary, 1891; Luxemburg, 1901; Norway, 1909; Serbia, 1910; Great Britain, 1911; Russia, 1912; Rumania, 1912; Netherlands, 1913. In addition many other countries have compulsory health insurance systems for specific industrial groups (particularly mining, railroad and navigation). Compulsory social health insurance has therefore become the predominating form of health insurance for wage-workers.

Under the subsidized form, it is the effort of the state to stimulate the voluntary co-operative efforts through offers of financial aid from the public treasury. These subsidies were very slight in Belgium and France, somewhat higher recently in Sweden and substantial in Switzerland and Denmark; in the latter country they represent nearly one-third of the total cost of insurance. The effect of the subsidies in stimulating insurance is roughly proportionate to the amount of subsidy; Denmark showing the greatest effect, so that nearly 30 per cent of its population is insured.

Compulsory Health Insurance.— It is argued in favor of the compulsory method, first introduced on a large national scale in Germany in 1884, that only through compulsion can the neediest and poorest of the wage-workers be brought under and kept under the insurance system, and moreover that only through compulsory system can a part of the cost of the system be placed upon the employers and industry. The rapid extension of the compulsory type of legislation, especially since 1909, seems to indicate a general conversion to this point of view in Europe. It is understood that but for the European War, several other countries would have been ready to introduce compulsory health insurance systems, and it is generally recognized that at least as far as health insurance is concerned, the compulsory principle has won among expert students of the problem after 25 or 30 years of experimentation in Germanic countries.

Though the 10 compulsory health insurance acts differ considerably in the various details, they agree more or less in certain substantial features. The compulsion is usually made applicable to wage-workers or employed persons within certain income standards. It is not considered necessary to include persons in comfortable circumstances; and persons without an employer are too difficult to keep under the system. For the same or other reasons certain wage-groups are omitted. In all the 10 systems the employer is required to contribute a part of the cost, though the exact amount differs from one-third in Germany to one-half in Hungary. The justification for such contribution from the employer is found partly in the responsibility of industry for a certain portion of the illness among the employees, partly in the responsibility of industry to pay a living wage to the employee, and the recognition that support during, and care of, sickness must somehow come out of the wage, and finally in the consideration that the increased efficiency arising from proper care of the employee will more than compensate the employer for the cost.

The state contribution to compulsory health insurance is a comparatively new principle, though it constituted the backbone of the "subsidized voluntary insurance." Norway made the first effort to include the state subsidy into the compulsory system, but the most important application was found in the British Act of 1911, where the state assumed two-ninths of the total cost, and in addition furnishes various numerous supplementary subsidies, which probably make the state subsidy equal to about one-third of the whole cost.

Benefits.— The benefits furnished by the various systems vary in detail, but on the whole follow fairly well-defined standards. The essential two benefits are a weekly allowance and medical aid. The Holland Act of 1913 is the only one which furnishes no medical aid. The weekly benefit is usually fixed on the terms of a percentage of wages (50 to 66⅔ in various acts, 70 in Holland) but the British act deviates from this in establishing a uniform benefit rate of 10 shillings for men and 8 shillings for women. The duration of these weekly benefits is usually determined at 26 weeks, and thus a line of demarcation is drawn between sickness and chronic invalidity and disability. The British act compensates for invalidity as well, but at a different scale, and after the expiration of the ordinary sickness benefit.

The amount and kind of medical aid required by the act varies, but in actual practice most of the older systems go beyond the requirements of the law in this respect, fairly furnishing hospital aid. Drugs, supplies, etc., must be furnished to the sick according to all the acts except that of Holland. There are two additional benefits which are almost as universal as the two essential ones. Under all the 10 acts, maternity benefits of some kind or other are given to the insured working women who become mothers, and they usually consist of a special allowance for medical aid, etc. (or such medical and nursing aid in kind) and the regular money benefit for a specified number of weeks (from 4 to 12 weeks) provided the mother abstains from work.

Finally all the acts, with the exception of the British, give a modest funeral benefit. Health insurance cannot undertake to solve the financial problems arising out of the death of the family's breadwinner, but all the systems recognize the necessity of meeting the unexpected funeral expenses at the time when the family is most helpless. In Great Britain this benefit was kept out of the National Insurance Act by the influence of the large industrial life insurance companies, whose policies are held in such large numbers by the wage-workers mainly for the purpose of meeting funeral expenses.

There is a general tendency to extend the benefits of health insurance to the dependents of the insured wage-workers especially as far as medical and funeral and the maternity benefits are concerned. That is already required by the acts of Hungary, Norway and Rumania, and is practised by a good many large German funds. This is based upon the recognition that the efficiency of the health insurance system in improving the general health conditions of the community would be seriously limited by exclusion of the wives and children from the benefits of the improved medical service.

Since the entire method of health insurance has originated in workingmen's mutual benefit societies this has considerably influenced the organization of social health insurance. In most acts a certain variety of organization is permitted. The basic or ideal organization is a «local» sick insurance fund, limited to a definite locality; many such funds may, however, exist in the same locality, embracing various industries, or special funds may be organized for employees of individual establishments. These funds are administered according to the requirements of most acts, by joint boards representing employers and employees, according to their respective contributions to the cost. The British system is, however, organized on a very much different basis. The friendly societies had been so strong at the time the act was passed, that to them, under a new designation, «approved societies,» was left the practical administration of the health insurance system. The essential difference is that these «approved societies» are administered exclusively by their insured without participation of the employers, that these societies are bound by no geographical or occupational limits, that the choice between any of them is unrestricted. Because of these conditions, it was found impracticable to entrust these societies with the administration of medical aid, which is managed by independent local committees. It is generally admitted that the British plan, from an administrative point of view, is not very efficient.

While these 10 acts are compulsory as to their application and as to certain specified benefits, they usually provide for voluntary extension. Voluntary members within certain economic groups may be admitted and the numerous autonomous funds may extend the various benefits required by the law, either in time, amount or quality, or may add certain other benefits permitted by the act. This is possible because of the financial autonomy, since under most acts the numerous funds are permitted to charge their insured and the employers as much (within prescribed limits) as is necessary to pay the benefits agreed upon by the representatives of employers and employees. Again the British act is an exception to this rule, since the law determines the weekly contributions which cannot be increased by the individual societies, in which the wage-workers are insured.

Growth.— Health insurance is the most developed branch of social insurance next to compensation for industrial accidents, and is probably the largest in actual extent of work done and funds collected and distributed. Probably from 40,000,000 to 50,000,000 wage-workers with their families in Europe enjoyed the protection of compulsory health insurance before the war. In 1912 the German system alone had 21,659 funds with 13,217,705 members, an income of 417,600,000 marks ($99,400,000) and an expenditure of 395,000,000 marks ($94,000,000). Of this amount $39,400,000 was paid in money benefits of various kinds, $20,400,000 for physicians' services, $13,000,000 for drugs, $12,800,000 for hospital treatment and only $5,140,000, or less than 5½ per cent, for administrative expenses.

Movement in the United States.— With the rapid extension of workmen's compensation for industrial accidents in 34 States in the brief period of 1911 to 1916, and also for industrial diseases in a few States, an object lesson in social insurance methods has been given, which quickly developed into a demand for the extension of the same principles and methods to health insurance. In the fall of 1915 the American Association for Labor Legislation issued a tentative draft of a compulsory health insurance act, which was introduced in the spring of 1916 in the legislatures of Massachusetts, New Jersey and New York. These bills failed of passing but led to the appointment of an investigating commission in Massachusetts and a similar commission appointed in 1915 in California had specialized in health insurance. The American Medical Association, the American Public Health Association, the National Conference of Charities and Correction and many similar organizations, as well as State federations of labor, and national or international labor unions have either formally endorsed or shown an earnest interest in health insurance. The United States Commission on Industrial Relations made a report in favor of it, and the United States Public Health Service and the United States Department of Labor have come out in support of it. The public hearings held in Albany in March 1916, in Boston in March 1916 and again in October 1916 and in San Francisco in November 1916, have demonstrated a very live interest in, and growing support of, the social health insurance movement. There is little doubt that the United States stand ready to enter upon a policy of health insurance more or less following various European standards.

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raphy); American Medical Association, Social Insurance Pamphlets, 1–7 (1916–17); Health Insurance, Standards and tentative draft of an act, prepared by the American Association for Labor Legislation, 1916. See also references under Social Insurance.

HEALY, George Peter Alexander, American painter: b. Boston, 15 July 1813; d. Chicago, 24 June 1894. He went to Paris about 1836, where he remained several years, alternating his residence there with occasional visits to the United States. Among works executed by him abroad are portraits of Louis Philippe, Marshal Soult and General Cass. At home he painted Calhoun, Webster, Pierce and other prominent American statesmen. He occasionally produced large historical pictures, of which ‘Webster's Reply to Hayne,’ illustrating a well-known scene in American legislative history, completed in 1851, now hangs in Faneuil Hall in Boston. At the exhibition of Paris in 1855 he exhibited a series of 13 portraits and a large picture representing Franklin urging the claims of the American colonies before Louis XVI, for which he received a medal of the 2d class. Portraits by him of Buchanan and Lincoln are in the Corcoran Gallery at Washington.

HEALY, John, Irish Roman Catholic archbishop: b. Ballinafad, County Sligo, Ireland, 14 Nov. 1841. He was educated at Summerhill College, Athlone, and at Maynooth College. In 1867 he was ordained to the priesthood, and became successively professor at Summerhill College, curate at Ballygar, County Galway, curate at Grange, County Sligo, and finally professor of theology at Maynooth from 1867 to 1883. He edited the *Irish Ecclesiastical Record* in 1883–84 and in the latter year was appointed coadjutor to Dr. Duggan, bishop of Clonfert. He succeeded the latter on 15 Aug. 1896 as bishop of Clonfert and in 1903 became archbishop of Tuam. As bishop of Clonfert he greatly advanced the cause of secondary education by founding a college at Cappatagle in 1892; this he subsequently transferred to Esker, Athenry, and in 1901 the college was removed to Ballinasloe. In 1884 Dr. Healy engaged in a controversy with Cardinal Newman on the extent of the inspiration of the Bible. He was senator of the late Royal University of Ireland and is senator of the National University of Ireland and member of the governing board of University College, Galway. He is also commissioner for the publication of the Brehon Laws. He has published ‘Ireland's Ancient Schools and Scholars’ (1890), the authoritative work in its special field; ‘Centenary History of Maynooth College’ (1895); ‘Record of the Centenary Celebrations of Maynooth College’ (1896); ‘Life and Writings of Saint Patrick’ (1905); ‘Irish Essays’ (1908) and contributions to ‘The Catholic Encyclopedia’ (1910), the *Dublin Review*, *Irish Monthly* and the *Irish Ecclesiastical Record*.

HEALY, Timothy Michael, Irish political leader: b. Bantry, County Cork, Ireland, 17 May 1855. He was elected to Parliament for Wexford in 1880, County Monaghan in 1883, South Londonderry in 1885, North Longford in 1887 and County Louth, North, in 1895. In 1884 he was called to the Irish bar. He became known as a leader of the Irish Nationalist party, was a founder of the Dublin *National Press* (later combined with the *Freeman's Journal*), and was repeatedly in difficulties because of his public utterances on political matters. He made a lecture tour of the United States with Dillon and Parnell in 1880, and in 1881 participated in the Land League convention at Chicago, when $250,000 were contributed to the Irish cause. The “Healy Clause” of the Land Act of 1881, providing that no tenant should pay rent on improvements made by him, was introduced by him. He wrote ‘A Word for Ireland’ (1886).

HEAP, David Porter, American engineer: b. San Stefano, Turkey, 24 March 1843; d. 25 Oct. 1910. He studied at Georgetown College, was graduated from the United States Military Academy in 1864, served in the Civil War with the engineer corps of the Army of the Potomac and was brevetted captain for his services. In 1895 he attained the grade of lieutenant-colonel of engineers. He was for years employed in the construction of fortifications and the improvement of harbors, and in 1881 was military representative of the United States at the Paris congress of electricians. In addition to a ‘Report on the International Exhibition of Electricity at Paris’ (1884), he published ‘Ancient and Modern Light-Houses’ (1889); ‘Electrical Appliances of the Present Day’; ‘Engineer Exhibit, Centennial Exhibition’ (1882); and ‘History of the Application of Electricity to Lighting the Coasts of France’ (1885).

HEARING, one of the five senses, the physical organ of which is the ear See Ear; Acoustics.

HEARN, hėrn, **David William**, American Roman Catholic clergyman and educator: b. Boston, Mass., 21 Nov. 1861. He was graduated at Boston College in 1880; took post-graduate courses in literature, science and philosophy for five years, and theological courses for four; entered the Society of Jesus, and was ordained priest of the Roman Catholic Church. He was successively professor in Georgetown University, vice-president of Boston College and vice-president of the College of Saint Francis Xavier, New York. In 1900 he became president of Saint Francis Xavier. His term as president ceased September 1907, and he was appointed dean of Boston College. In 1909 he became head master of Loyola School and rector of Saint Ignatius Loyola Church, New York. He built and opened in 1914 the Regis High School, the first Roman Catholic free high school. His term of office ended 27 Sept. 1915, when he was appointed dean of Canisius College, Buffalo, N. Y.

HEARN, Lafcadio, American author: b. Santa Maura (Leucadia), Ionian Islands, 27 June 1850; d. Tokio, Japan, 26 Sept. 1904. His father was an Irish officer, his mother a Greek. Educated in England and France, he came to the United States in 1869, was a journalist in Cincinnati and New Orleans, in 1887–89 was at Saint Pierre, Martinique, French West Indies, and in 1890 went to Japan. He became a Japanese subject with the name Yakumo Koizumi, and was appointed lecturer in English literature at the Imperial University of Tokio. His ‘Stray Leaves from Strange Literature’ (1884), and ‘Some Chinese Ghosts’ (1887), were succeeded by ‘Chita: A Memory of Lost Island’ (1889), story of the destruction of «L'Ile Dernière,» once the watering-place of Louisiana fashion, which attracted attention by its descriptive powers; and ‘Two Years in the French West Indies’ (1890), which gained new interest through the Martinique disaster of 1902. Among his further works, dealing almost exclusively with things Japanese and revealing a thorough comprehension of and sympathy with the art, myth, tradition and philosophy of the Orient, are ‘Out of the East’ (1894); ‘Glimpses of Unfamiliar Japan’ (1895); ‘Kokovo’ (1896); ‘Gleanings in Buddha-Fields’ (1897); ‘Exotics and Retrospections’ (1898); and ‘Kottō, or Japanese Curios’ (1902); ‘In Ghostly Japan’; ‘Japan: An Attempt at Interpretation’; and ‘Kwaidan’ (1904). Consult the ‘Life and Letters’ (1906) and the ‘Japanese Letters’ (1911), ed. by Bisland; the ‘Japanese Appreciation’ by Noguchi in the *Atlantic Monthly* (1910); Setsuko Koizumi (Mrs. Hearn), ‘Reminiscences of Lafcadio Hearn.’

HEARNE, Samuel, English explorer: b. London, England, 1845; d. 1792. He entered the service of the Hudson's Bay Company, and was sent out to Fort Prince of Wales on Hudson Bay. After two abortive efforts in 1769, he in 1770 set out on his third and successful attempt to discover the Coppermine River, reached its mouth in July 1771, and returned to Fort Prince of Wales in 1772. Two years later he built Cumberland House, on the Saskatchewan. See Tyrrell's edition of his ‘Journey from Fort Prince of Wales Fort in Hudson's Bay to the Indian Ocean,’ published by the Champlain Society in 1910.

HEARST, Phœbe Apperson, American philanthropist: b. 1842. She was for a time a teacher, and in 1861 married George F. Hearst of California; William Randolph Hearst is her son. She has been active in charitable and philanthropic enterprises and has given largely, especially to educational institutions. In San Francisco she has established kindergarten classes for the children of the poor and a manual training school, and has organized a number of working girl's clubs. She has also given money to build a National Cathedral School for girls; has made donations to the American University at Washington; has established and given largely to public libraries in the mining towns of the West; and maintained a school for mining engineers at the University of California. In 1896 she offered to pay the expenses of an international competition of architects to obtain a suitable plan for a campus and buildings for the University of California, and to erect two buildings in accordance with this plan. See CALIFORNIA, UNIVERSITY OF.

HEARST, hèrst, **SIR William Howard,** Canadian statesman: b. Arran township, Bruce County, Ontario, 15 Feb. 1864. He was educated at Collingwood Collegiate Institute and Toronto University. He was called to the bar in 1888 and began practise at Sault Sainte Marie, where he held a leading place as counsel. He was elected member for Sault Sainte Marie to the provincial legislature in 1908 in the Conservative interest, became Minister of Lands, Forests and Mines in the administration of Sir James Whitney in 1911, and on the death of that statesman in 1914 succeeded him as Premier of Ontario.

HEARST, William Randolph, American newspaper publisher: b. San Francisco, 1863. Educated at Harvard, on leaving college he took charge of the publishing of the San Francisco *Examiner,* formerly owned by his father, Senator Hearst of California. In 1895 he bought the New York *Journal,* the name of the morning edition of which he later changed to the *American;* in 1900 he started the Chicago *American;* in 1904 the Boston *American* and the Los Angeles *Examiner.* He is also proprietor of the Chicago *Examiner,* the Atlanta *Georgian,* the New York *Evening Journal,* the New York *Deutsches Journal,* the *Cosmopolitan Magazine, Hearst's Magazine, Good Housekeeping, Harper's Bazar, Motor Magazine* and *Motor Boating Magazine.* In 1902 he presented the Greek Theatre to the University of California. He represented the 11th Congressional District (New York) in the 58th and 59th Congresses. In 1905 and again in 1909 he was defeated for the office of mayor of New York city and in 1906 for governor. Under him so-called «yellow journalism» throve and the typography of all American newspapers materially changed. He is credited with the invention of the «spread news head.» He is in control of the syndicate known as the International News Service.

HEART, Anatomy and Functions of the. The continuity of life depends upon nutrition supplied to the individual organs that together constitute the human body. The nutritive material is the blood; its equable distribution is accomplished by a central pumping organ, known as the heart.

Situation and Anatomical Relation.— This organ is situated in the central and lower part of the thoracic or chest cavity and rests upon the upper convex surface of the diaphragm. It is pear-shaped, with its base directed upwards, backwards and toward the right side; while its apex points downward and forward to the left side and strikes the chest wall in the space between the fifth and sixth ribs, one to one and a half inches to the right of an imaginary line drawn vertically through the left nipple. The heart is enclosed in a sac called the pericardium. The anatomical relation between the pericardium and the heart is such as to allow the latter, within its envelope, relatively free motion. This is necessary in order to enable the heart to perform the physiological function of controlling the circulation. But to maintain this liberal mobility, and at the same time to keep the heart within its proper boundaries, the pericardium is secured to its adjacent structures; namely, beneath, to the central tendon of the diaphragm; in front, to the breastbone (sternum); laterally, to the sides of the coverings of the lungs facing the pericardium (mediastinal pleura); and behind, to the anterior surface of the food-conducting-tube (œsophagus) and the large wind pipes (trachea and large bronchi).

Dimensions and Structure.— The size of the heart gradually increases until middle life, from which time it remains practically unchanged until old age; then it gradually diminishes. The average weight of the heart has been calculated to be one one-hundred-and-fiftieth (1/150) of the weight of the body in the male, and one one-hundred-and-sixtieth (1/160) in the female. The dimensions of the heart in adults are about five inches in length, three and a half inches in its greatest width and two and one-half inches in its extreme thickness. Considering the topography of its normal apex and its dimensions and position, it is evident that the major portion of the heart lies to the left of the median line. By virtue of the structure of its component parts the heart is able to direct and control two currents of blood which differ from each other in their chemical composition, and hence in their functions. One of the currents leaves the heart by one channel and, after traversing a designated distance and performing its function, returns to the heart by another avenue, to leave it again through another exit; and ultimately returns to the place where it first left the heart. Because of this uninterruped circuitous course, Harvey in 1628 named it *Circulation*. This circulation continues throughout the life of the individual.

The heart is a hollow, muscular pouch, whose interior is divided by a longitudinal partition into two cavities, which have no direct communication with each other. From their anatomical position in the chest cavity, these two heart cavities are called, respectively, the right and the left heart. Each of these hearts is in turn subdivided transversely into two compartments; the upper is called auricle and the lower ventricle. The two chambers of each heart communicate freely with each other; that is to say, the right auricle with the right ventricle, and the left auricle with the left ventricle. This is accomplished through openings between them called the auriculo-ventricular openings. These apertures of communication are guarded by valves which are so constructed that they automatically open and close within a given period of time, thereby allowing a stream of blood to pass freely from the auricle to the ventricle, but not in the opposite direction.

The capacity of each chamber of the heart in adults is about three to three and a half ounces. The wall of the heart is composed of three coats. The outer coat is called the epicardium and constitutes one of the component layers of the pericardial sac. The inner surface of the two pericardial layers are required to glide over each other during the movements of the heart. To prevent their undue friction, the sac is provided with a lubricating substance, called lymph or pericardial fluid. The middle coat is actually the muscle of the heart, and is called the myocardium. It is made up of bands and layers of muscular tissue, very intricately arranged. The accounts of their interlacement, given by different investigators, vary. It is certain, however, that three distinct units can be identified, namely, the fibres of the auricles, those of the ventricles and the auriculo-ventricular bundle of His, so named after its discoverer. The work performed by muscles in general depends upon two properties that they possess, extensibilty and perfect elasticity. The rhythmic exercise of these two properties by the myocardium creates sufficient kinetic energy for the propelling of the blood currents. The inner coat, called the endocardium, lines the whole interior of the heart. By its reduplication, the endocardium forms part of the valves at the auriculo-ventricular and arterial orifices, namely, between the auricles and their respective ventricles and the ventricles and the vessels that emerge from them. Each orifice is encompassed by a strong fibrous ring which serves for the attachment of the corresponding auriculo-ventricular muscle and its valve. The rings at the arterial orifices bind the lower margin of the ventricular muscle and its valve. The boundary between the auricles and ventricles is marked by a perceptible groove in which lie the nutrient vessels (coronary arteries) of the heart substance.

Systems of Control.— The action of the heart's mechanism is subject to the absolute control of two sets of nerves. These are the cardiac branches of the two nervous systems, the cerebro-spinal and the sympathetic. They pass to the heart and terminate in its wall as ganglionic cells whose filaments in turn are distributed among the muscular fibres of the heart. The action of each of these two systems is antagonistic to that of the other. The sympathetic system produces acceleration of the heart beats and is therefore called the accelerator nerve; while the influence of the cerebrospinal system is just the opposite and is named the inhibitory nerve, as it checks the augmenting and accelerating action of its opponent.

Under normal circumstances, there exists an equilibrium in their activity, which results in the rhythmic and steady action of the heart. This consists of the simultaneous contraction of both auricles, termed the auricular systole; followed, after a slight pause, by a simultaneous contraction of both ventricles, called the ventricular systole. A general relaxation (diastole) of the whole heart completes the cardiac cycle. The average duration of a cycle is about eight-tenths of a second, which is divided approximately as follows: Auricular systole, one-tenth; auricular diastole, seven-tenths; ventricular systole, three-tenths; ventricular diastole, five-tenths; common pause, four-tenths. The heart rests a little over nine hours out of every 24. During this period of rest, the heart accomplishes for itself what it does for the rest of the body in nearly 14 hours — that is, it feeds itself. This is done by the blood passing through the coronary arteries into the heart, whence the deoxidized blood is returned through the coronary sinus into the right auricle. The blood that feeds the tissues is called arterial blood. Its color is bright red, and it is carried in vessels known as arteries. (Vessels that carry blood from the heart are known as arteries irrespective of the kind of blood they carry and those bringing the blood to the heart are known as veins). During its travel through the system, the blood gives up its nutritive elements and becomes dark red in color; and is then transferred, through the intermediary of microscopic vessels called capillaries, into another set of vessels, termed veins. The veins, through an extensive ramification of vessels throughout the body, collect venous blood, and carry it into the right auricle through two large venous trunks called the superior and inferior vena cava. During the auricular systole, the venous blood is forced into the right ventricle. When this chamber is filled, the auriculo-ventricular bundle of His conveys the impulse of systolic contraction to the ventricle, and the next phase of the cardiac cycle sets in. During this period the auriculo-ventricular valve (tricuspid on the right side, bicuspid on the left) closes to prevent regurgitation of the blood into the auricle. The vibrations resulting from the ventricular contraction and the forcible closure of the valves are productive of the first sound of the heart. At this time the intra-ventricular pressure is high. The closed auriculo-ventricular valves at this instant are subjected to this pressure, since they then form the roofs of the ventricles. To prevent their diverging upward into the auricles, the valves are provided with non-elastic cords (chordæ tendinæ), one end of which is attached to the ventricular wall and the other to the under-surface of the valve. The contraction of the right ventricle forces the blood into the pulmonary artery, the resistance of which causes the closure of the semi-lunar valve guarding its orifice. The closure gives rise to the second sound of the heart. Immediately thereafter, the ventricle relaxes and the auriculo-ventricular valve opens; and the pressure from behind forces the blood into the lung capillaries, where it becomes oxidized by the absorption of oxygen from the alveoli of the lungs. It is then propelled through the pulmonary veins into the left auricle. This constitutes the pulmonary or lesser circulation.

Governed by identically the same physical laws and accompanied by the same phenomena described in the circulation of the right heart (the same action takes place in the left heart simultaneously with the action in the right heart), the blood which is now arterial is propelled from the left auricle into the left ventricle; from there into the aorta (the largest artery in the human body) and traversing the arterial capillary and venous channels, it finally reaches again the right auricle. Thus the greater or systemic circulation is completed.

The systemic circulation controlled by the left heart and the pulmonary circulation controlled simultaneously by the right, together constitute the entire function of the heart.

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J. Oshlag, M.D.

HEART, Diseases of the. The heart is a sensitive register of the condition of the entire human system. When an acute disorder sets in in our body, irrespective of the distance from the heart, and even while the heart itself is enjoying absolute integrity, the action of the heart changes almost instantaneously. Whether the lesion is a gouty swelling of the big toe, water around the lungs (pleurisy with effusion), or an abscess in the middle ear, the heart will at once indicate the disturbance by its accelerative action, as it sends an increased force of white blood corpuscles to the seat of the trouble. A decrease in the quantity of the coloring matter of the blood (Hemoglobin) causing anæmia, or a foreign substance circulating in the blood, as bile in the case of jaundice, will at once alter the normal action of the heart.

Structural Deterioration.— Temporary embarrassment of the heart caused by any systemic disturbance does not produce any structural derangement in its substance. The elimination of the disease or disturbance as the case may be will be followed, as a rule, by the restoration of the heart to its normal state. If, however, the disturbance continues, and the heart is required to labor under abnormal conditions for a long time, the added exertion leaves an unfavorable effect on its structural soundness; its nutrition becomes impaired, and its working capacity gradually exhausted. These phenomena are due to physical laws of cause and effect, though the cause is often obscure. The gradual progress of deterioration of the heart can in very many instances be traced with precision to the diseased organ which causes it, as for example, in diseases of the kidneys.

The function of the kidneys is to separate the urinary constituents from the blood, which, in order to free itself of its effete materials, such as urea, etc., enters the kidneys through the renal arteries. These arteries divide and subdivide within the substance of the kidneys and finally terminate in collections of capillaries, called glomeruli. The blood is forced into the glomeruli by the heart. In some diseases of the kidneys, as in interstitial nephritis, a permanent destruction of glomeruli takes place, and yet the same quantity of blood as in the normal state of the organ is forced through the remaining capillaries. To accomplish this task a superior force is needed and the heart has to furnish additional energy, the amount of which is in direct proportion to the number of vessels destroyed. This additional work of the heart is made possible by a gradual increase in the thickness of the myocardium. But this increase cannot go on indefinitely, and an incompetency of the heart is finally observed in the general circulation. Such sequential cardiac disability invariably sets in, whenever the heart encounters abnormal and permanent resistance, irrespective of the cause or place of such resistance.

Among other extrinsic influences that lead to cardiac inadequacy, there is one wielded by paroxysmal tachicardia (palpitation). In this condition, there is a derangement in the action of the heart without there being any demonstrable cardiac disease. The number of beats often reaches to about 250 per minute. This extraordinary labor deprives the heart of its rest and proper nutrition, and eventually leads to its exhaustion. The attacks come on in paroxysms and are probably due to some derangement in some of the internal organs, which thereupon reflexly produce the pernicious effect upon the heart's mechanism.

Among the cardinal symptoms of exophthalmic goitre, tachicardia is the most distressing one; and if its influence is not checked it ultimately brings about a morbid condition in the heart's mechanism. The exact cause of tachicardia and the pathology (structural changes) that underlie its promulgation are still definitely undetermined. It is however reasonable to presume that the inhibitory nerve, through some unknown cause, loses its restraining influence on the action of the sympathetic nerve.

The morbid change an organ has to undergo because of a disease existing in another part of the body is called a secondary disease, while the original lesion in any of the organs is known as a primary disease. Most diseases of the heart are secondary. The component parts of the heart are affected individually, each disease constituting an entity and presenting salient symptoms characteristic of the particular part involved. Thus a lesion in the endocardium, called endocarditis, differs from one of the myocardium, known as myocarditis. But the interrelation between the heart's constituents is such that the myocardium is always made to suffer whenever its adjacent structures are affected by disease.

How the Heart is Infected.— It is established beyond doubt that the blood, in all infectious diseases of known origin, harbors the specific organisms of those diseases. Impregnated with these disease-generating microbes, the blood, during its travel through the heart, comes in contact with the endocardium. This constant exposure of the endocardium to these infectious agents renders it an extremely susceptible prey to inflammatory processes known as acute endocarditis. The following bacteria have a special predilection for the endocardium and are, therefore, more often prone to excite endocardial trouble: the streptococci, staphylococci, gonnococci, pneumococci and micrococcus rheumaticus. The severity of the symptoms, according to which the disease is divided into two classes, namely, simple or mild, and malignant or severe endocarditis, depends upon the virulence of the invading bacteria. The simple form of the disease does not always cause destruction of life directly. The patient usually recovers; but is left with crippled valves which ultimately cause his death; while the malignant type invariably terminates fatally. The left heart is affected more frequently, probably because the blood it carries is relatively rich in oxygen which is essential for microbic growth and activity. The skin and the mucus membranes (the inside lining of the organs) are the portals through which those microbes gain their entrance into the system. Cases are recorded where insignificant injuries to the skin, such as the prick of a needle, were followed by malignant endocarditis, long after the local wounds had healed. The infections that originate in the mucus membranes and are directly responsible for the subsequent development of acute endocarditis are very numerous. The most prominent of these infections are abscesses in the nose and its adjacent sinuses; some diseases of the larynx and trachea; suppuration in the mouth, such as abscesses around the teeth; diseased tonsils; ulcerations of the lining of the intestines, which constitute the lesions in typhoid fever, in dysentery and in intestinal tuberculosis; infection of the gall bladder; diseases of the genito-urinary canal such as gonorrhœa, and infections following retention of the afterbirth (placenta); all these are perpetrators of that evil — endocarditis.

Although the whole endocardium of the affected heart-chamber is involved, the valves bear the brunt of the trouble. They lose their superficial layer of cells, called endothelial cells, and the now raw surfaces become covered with white blood corpuscles and fibrin (constituents of the blood). These new elements are known as vegetations; and as the disease progresses still other structural changes take place in the valve-substance; a new growth of fibrous tissue develops, which causes the valve to become thick, distorted and rigid. This new growth has a tendency to contract and thereby causes a diminution in the dimensions of the valve. Its flaps being shortened do not approximate perfectly, when they are required to do so, and the closure of the auriculo-ventricular and arterial orifices is rendered imperfect. At other times, the flaps of the diseased valves become adherent either to their surrounding structures or to one another. The valve is then unable to open freely when it should do so. Thus the structural alterations in the valves render them incapable of properly performing their physiological function; that is to say, they do not open at the right time, in order to furnish a free passage to the blood current through the designated orifice. This condition is known as obstruction or stenosis of the valve. On the other hand the contracted valves do not perfectly close the orifices which they are made to guard, and, therefore, are unable to prevent a backward flow of the blood. This condition is known as insufficiency of the valve, also as regurgitation, because of the backward flow of the blood.

Obstruction and insufficiency may coexist in the same valve. Insufficiency of the left auriculo-ventricular valve, known as the bicuspid or mitral, is of the most frequent occurrence among the diseases of the endocardium. The imperfect closure of the orifice during the ventricular contraction allows a part of the blood from the ventricle to regurgitate into the left auricle which is then receiving its normal blood supply from the pulmonary veins. The auricle under pressure is now obliged to accommodate twice as much blood forced into its cavity from the two opposite sources. The forcible encounter of the two waves coming from the opposite directions causes them to rebound, producing a vertiginous movement of the blood which gives rise to a blowing sound called cardiac murmur. As the murmur occurs during the ventricular systole, it is, therefore, known as a systolic murmur. The auricle, in order to accommodate a larger quantity of blood, must expand its cavity. This expansion is accomplished through the forcible stretching of the auricular wall and is known as dilatation. At this time, the over-distended auricle being forced to overcome the greater amount of resistance it encounters in propeling the larger quantity of blood from its cavity, must utilize a proportionately greater amount of force. This is made available by a gradual increase in the bulk of the auricular myocardium known as hypertrophy. The left ventricle which is the recipient of the auricular contents is now subjected to the same structural alterations; namely, to dilatation of its cavity and hypertrophy of its wall.

When the evolution of the cardiac changes are in direct proportion to each other, namely, the more dilatation, the more hypertrophy, the heart is said to be in a state of compensation; at which time the disturbance is still confined to the left cardiac chambers. The great stress thrown on them is not felt in the general circulation, since the greater quantity of blood the ventricle propels with each systole does not reach the arterial system, but is forced back into the auricle. But this equilibrium is relatively short lived. The left myocardium becomes exhausted from abnormal activity, and the left ventricle can no longer expedite the blood-current. The stagnation which ensues in the ventricle extends into the impotent auricle, and the whole task of maintaining both the systemic and the pulmonary circulations is thrust on the right ventricle. Compensatory hypertrophy, which develops in the right ventricle, enables it to perform its double function but for a short time. The extraordinary resistance it encounters gradually exhausts its myocardium and phenomena of stagnation sets in. The veins, unable to empty themselves freely, become overdistended, and the watery constituent of the blood they contain, transuding through their walls, infiltrate the surrounding tissues and cause œdema (swelling). The stasis in the pulmonary capillaries interfere with the proper oxidation of the blood, and produces the distressing symptom of dyspnea (shortness of breath). The poorly aërated blood becomes bluish in color, giving rise to the third characteristic symptom of a non-compensated heart, namely, cyanosis (blueness). All the other organs, such as the liver, stomach, spleen, kidneys, etc., are in a state of venous stasis (passive congestion). Deprived of proper nutrition, they become crippled, functionate imperfectly, and often in a perverted manner. To relieve itself and alleviate the difficult situation, the heart utilizes its periods of rest by converting them into periods of work, often doubling the number of beats per minute. This tachicardia, as merely an expression of cardiac distress, differs from the paroxysmal variety, which produces distress.

Medical science when judiciously employed can often restore the decompensated heart; and the disorganized members of the human economy are again brought into a harmonious state. This is accomplished through the medium of two groups of remedial agents; one group exerts its restraining influence upon the action of the sympathetic nerve, while the other group acts directly on the inhibitory nerve by augmenting its power of inhibition.

Stenosis and insufficiency of the other valves of the heart cause that organ to undergo practically the same morbid changes as described in mitral insufficiency. There are, however, some modifications which occur during the evolution of the different pathological conditions. But the ultimate result in the heart itself, the disturbed relations and often the perverted functions which ensue in all the other organs of the body are identically the same.

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HEART IN ART AND SYMBOLISM. The heart is commonly considered the symbol of Charity. In ecclesiastical lore Pugin says: "The heart is always regarded as the seat of the affections," hence "fitting emblem of the great love of our Redeemer for the human race." In art, he tells us: "The field of the heart should be of ruby color, as an emblem of the intensity of divine love." In ecclesiastical art an emblematic device is that termed the "inflamed heart"; it is in the form of a conventional heart surmounted by flames. An inflamed heart is frequently placed between the hands of sculptured or painted saints to symbolize, in such cases, their love of God. The inflamed heart symbol is greatly favored by the Jesuits, who frequently represent Jesus Christ holding his robe open and displaying an abnormally large inflamed heart in the centre of the breast. According to Husenbeth the following saints have a heart as attribute: Francis of Sales has been pictured with the sacred heart of Jesus crowned with thorns above him in glory, or holding a heart in his hand; Saint Augustin has been variously depicted holding an inflamed heart, an arrow or two arrows crosswise in a heart; Saint Catherine of Siena has been represented as crowned with thorns, crucifix and inflamed heart, or with a crucifix upon a heart, or holding an inflamed heart; Saint Mary Magdalen of Pazzis has been pictured with an inflamed heart and crown of thorns; Saint Theresa has been depicted with an inflamed heart in her hand; Saint Jane Frances has been represented also holding a heart; Saint Anzano has been pictured carrying a heart and liver. An Egyptian method of interment was that of abstracting the human organs before the process of embalment and placing these separately in vases, termed "canopic" (see VASES). One of the four vases held the heart and lungs and was surmounted by a cover representing a jackal head; it personified Tuamutef (a son of the god Horus) who presided over these two organs. Whether or not traceable to this ancient rite of the Nile dwellers, the fact remains that during the 12th and 13th centuries the burial of the heart in a separate and distant tomb apart from the body of the deceased was a custom frequently carried out. It may have found its impulse in the Crusaders who dying in foreign lands were desirous that their hearts (sometimes supposed to be the seat of the soul) should find final repose on their native soil. The practise of burying parts of the body in different places was forbidden by Pope Boniface VIII (end of 13th century), but Pope Benedict XI, his successor, allowed Philip le Bel to carry out this rite with members of his family. Known heart-burials of exalted persons are: William of Estonville, archbishop of Rouen, at Rouen Cathedral, 1067; Stephen, brother of Alan the Black and Red, at Saint Mary's Abbey, York, 1104; Robert de Arbrissel, founder of the Order of Fontevrault, in a monastery at Orsan, 1117; Giffard, bishop of Winchester, at Waverly Abbey, 1127; King Henry I, at Saint Mary de Pré, Rouen, 1135; William, 3d Earl of Warren, slain by the Turks in the Holy Land, 1147, had his heart sent to England and deposited in Lewes Priory; King Richard I, the Lion-hearted (*Cœur de Lion*), of England, had his heart buried in Rouen, body at Fontevrault (Font-Everard), end of 12th century; Louis VIII, at Auvergne, 1226; Henry III, of England, at Fontevrault (body in Westminster Abbey), 1272; Philip le Hardi, at Saint Denis (bowels at Narbonne), 1285; Eleanor, mother of Edward I, in choir of Friars Predicant, London (body in Westminster Abbey), 1290; Eleanor, wife of Edward I, heart in Black

Friars, body in Westminster Abbey, bowels in Lincoln Cathedral, 1296; Edward I, at Jerusalem, 1307. Robert Bruce, of Scotland, deputed Douglas to bury his heart in Jerusalem, but Douglas was killed in Spain fighting the Moors, and the Bruce heart was found in a silver case fastened to his neck; it was buried in Westminster Abbey, 14th century. Louis XII, found heart-burial at La Chapelle d'Orleans, bowels at Les Celestins, 1515; François I, at Haute Brùyere. Other kings having separate heart burials were Henri II, 1559; François II, 1560; Louis XIII, 1643; Emperor Leopold, 1705; Louis XIV, 1715, etc. The list is so long of such heart-burials so far discovered that they have formed complete works. Consult Pettigrew, T. J., 'Chronicles of the Tombs' (London 1878); Hartshorn, Miss, 'Enshrined Hearts of Warriors and Illustrious People' (London 1865).

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HEART OF MID-LOTHIAN, The. Sir Walter Scott's novel, published in 1818, takes its title from the Old Tolbooth prison in Edinburgh, the scene of the Porteous riots of 1737, with a description of which the story opens. The narrative involves a varied group of well-drawn figures, English and Scottish, but it is on the family of the uncompromising old Cameronian, Douce Davie Deans, that Scott dwells with the most loving care, producing a portrait of the Scottish national character which is perhaps his very greatest achievement as a novelist.

Effie, the somewhat wayward but not deeply vicious daughter of Davie, has allowed herself to be seduced by George Staunton, alias Robertson, a young Englishman of good birth, dark and turbulent in spirit, but not without virtue, who has led a wild life among the Scottish smugglers. In order to rescue her from prison, where she is awaiting trial for child-murder, Robertson becomes leader of the revengeful mob which broke open the Tolbooth to seize and execute the unpopular Captain Porteous, but Effie, who has the keenest sense of her disgrace, refuses to escape. The real heroine of the story is Jeanie Deans, half-sister of Effie, a plain woman of sterling worth, firm in the Calvinistic faith for which her father has fought and suffered. She is told by Robertson that she can save Effie's life by affirming that her sister had informed her of her condition before the birth of her child. Though she is convinced of Effie's innocence, her conscience will not permit her at the trial to speak aught but the truth. The application of the Scottish statute hinges on this point and Effie is sentenced. There is but one way left to save her, and Jeanie resolves to take it. Alone and mostly on foot, she journeys, a simple Scottish peasant girl, to London, to seek a pardon from the king. Escaping, on the way, from the clutches of the terrible Meg Murdockson and her insane daughter, Madge Wildfire, she presents her case in person to the Duke of Argyle and later through his assistance to Queen Caroline, who, moved by Jeanie's simple eloquence, commutes the sentence to banishment. Returning she finds that the good Duke has provided a home for herself and her father and a living for her excellent lover, Butler, on one of his Highland estates, and that Effie, on her release, has eloped with Staunton. From this point the deeper interest of the story slackens. Years pass. Staunton falls heir to a great estate and Effie becomes a lady of fashion. Jeanie, coming by chance on a copy of the dying confession of Meg Murdockson, learns that Effie's child is still alive. Staunton, after tracing him into the hands of the Highland maurauder, Black Donacha, is attacked by the outlaws and slain by the hands of his own son. The latter is sent to Virginia where he meets a violent death. Effie spends some time with her sister and returns to London, carrying with her the sorrow of soul which has always been the punishment for her sin.

'The Heart of Mid-Lothian' is remarkable among Scott's novels in that the local, historical and romantic elements, though present throughout the story, are outweighed in interest by the true and beautiful portrayal of a simple human personality. Jeanie Deans commands the deepest affection and admiration of all Scott's characters. Her fortitude, her righteousness, her self-sacrificing loyalty and her indomitable will, combined with the shrewdness and good sense of the Scottish peasant, make her a heroine of an entirely different stamp from the pale Rowenas of romantic fiction. Simple and modest as she is, she has the courage, born of love, to surmount all obstacles and to stand unawed before dukes and kings. More after Scott's usual manner but scarcely less memorable is the historical portrait of the Duke of Argyle, that noble friend of Scotland, in whom the love of country and a keen relish for the simple virtues of its inhabitants have not been dimmed by rank and power. For references, consult article Ivanhoe.

James H. Hanford.

HEART-URCHIN, one of a group of sea-urchins (see Echinoidea) of elongated form and cordate outline from a lateral point of view. The group is best represented by the genus *Spatangus,* common in Europe, but heart-urchins occur elsewhere, and are known as fossils.

HEARTS-EASE, a violet (q.v.), especially the common yellow violet of Europe, or a pansy.

HEAT. Until the early part of the 19th century, it was generally believed that heat is a substance devoid of weight (imponderable), and diffused through the mass of bodies. This hypothetical substance was called *caloric.* Many phenomena seemed to be explained by the assumption of the existence of caloric, but finally, through the experiments of Davy and Rumford, in which heat was actually created from mechanical energy, the old caloric theory was abandoned. In its place we now have the molecular motion theory. According to this theory heat is nothing but a violent agitation of the molecules of matter. These molecules are extremely minute, but have a definite size and weight for each definite substance. It has been estimated that a molecule of water has a diameter of about one forty-millionth of an inch. Though molecules are small in size, their velocity, even at ordinary temperatures, is very great. In air, in which the molecules dart about in straight lines until they encounter other molecules, they attain a speed of 1,470 feet a second at the freezing temperature. The average length of their path between two encounters — the *mean free path* — is about 1-277,000 inch, and the number of molecules in a cubic inch of air is 443 million million million. Each molecule experiences about 5,000,000,000 collisions a second.

Expansion of Solids, Liquids and Gases. — The molecules of any substance attract one another with a force called cohesion. It is cohesion that prevents a wire from breaking when it supports a heavy weight. The pressure of the atmosphere also helps to hold the molecules of a body together. Opposed to both of these forces is heat. The effect of the agitation of the molecules is to make them jostle one another apart. Thus it is that in general an increase of temperature results in expansion. In solids, in which the cohesion is enormous, the expansion for a given increase of temperature is very slight, especially when the test is made at low temperatures. At higher temperatures, when the molecules have somewhat weakened their mutual hold through having moved further apart, an increase of temperature equal to the previous increase generally results in a somewhat greater expansion. To express such ideas technically we employ the expression *coefficient of linear expansion,* which means the fraction of its length that a bar expands when heated 1° Centigrade. As the length varies with the temperature, the length at the freezing point, 0° C., is taken as the standard length. Using then this expression, we may say that the coefficient of expansion of a solid generally increases with the temperature. The coefficient of linear expansion of a number of substances will be found in the following table:

COEFFICIENTS OF LINEAR EXPANSION OF SOLIDS.

Aluminium	0.0000222	Pine	0.0000054
Gold	0.0000147	Beech	0.0000026
Wrought iron	0.0000121	Ash	0.0000095
Cast iron	0.0000106	Mahogany	0.0000036
Lead	0.0000271	Vulcanite	0.0000636
Platinum	0.0000093	Paraffin	0.0001303
Copper	0.0000167	Quartz, vitrified	0.00000026
Zinc	0.0000297		
Silver	0.0000192	Ice	0.0000510
Steel	0.0000123	Glass tubing	0.0000083
German silver	0.0000183	Glass, Jena therm. 59 III	0.0000058
Invar	0.00000087		
		Porcelain	0.0000041

Two notable cases may be remarked. It is seen from the table that the coefficient for glass is very close to that for platinum. This fact is taken advantage of in the construction of incandescent electric lamps, and of those scientific instruments where it is necessary to have a wire pass through glass and leave an air-tight joint. In making the joint, the glass around the hole is softened by heat until it gathers closely around the hot platinum wire. In cooling, if the coefficient for platinum were higher than that for glass, the platinum would contract more rapidly than the glass and leave a leaky joint. The second case to be noted is that of Guillaume's nickel steel, known as invar. The coefficient of expansion of this metal is so extremely small that it is eminently suited to the construction of clock pendulum rods, of surveying instruments and of standard scales of length, and to many other purposes in which much expansion now proves an annoyance. Unfortunately the high cost of nickel will preclude the employment of this wonderful alloy in some cases.

The influence of expansion is seen in railroad tracks. On a cold day 60-foot rails may contract so as to draw apart one-half of an inch. The cables of the Brooklyn bridge support the slightly arched roadway. When they sag down in hot weather through expansion, they tend to make the roadway buckle. This tendency is increased by the expansion of the roadway itself. However, both tendencies were overcome through the foresight of the engineers, who provided a telescoping joint in the roadway at the middle of the span. The parts of this joint play in and out about a foot. On hot days clock pendulums grow longer, and so the clocks lose time. Glass when suddenly and hence unevenly heated expands more at one point than at another, thus introducing internal strains that cause fracture, but vessels made of vitrified quartz, on account of their extremely low expansibility, resist this tendency to crack; they will endure without injury the sudden application of a blowpipe flame.

In liquids the molecules are so far freed from cohesion that they are able to roll around one another and to wander from one position to another. The small remaining cohesion is assisted by the pressure of the atmosphere or by any other pressure to which the liquid may be subjected and so the molecules in the body of the liquid are prevented from flying directly apart. It is on account of this small resistance to expansion that we find liquids very much more expansible than solids. The term *coefficient of cubical expansion* is employed to express the degree of expansibility of a liquid. It means the fraction of its volume that a liquid expands when its temperature is raised 1° C. The cubical coefficient of a substance is three times as great as its linear coefficient, because we measure the effect of expansion in length, breadth and thickness, instead of merely noting the expansion in length. Of course a liquid confined in a tube of unchanging dimension could only expand in length, but the effect in this one direction would be three times as much as it would be if the liquid were allowed to expand proportionally in all three dimensions.

COEFFICIENT OF CUBICAL EXPANSION OF LIQUIDS.
AT 20° C.

Ethyl alcohol	0. 0112	Olive oil	0.00072
Ether	0.00165	Petroleum	0.00095
Water	0.00021	Glycerine	0.00050
Mercury	0.000182	Aniline	0.00118

The expansibility of water is strikingly irregular. Starting at the freezing point water contracts as the temperature rises until at about 4° C. it has assumed its maximum density. A further increase of temperature now causes the water to expand, which it does at an increasing rate until it begins to boil at 100° C.

Gases surpass even liquids in their expansibility. Because in gases the molecules are relatively very far apart, cohesion counts for nearly nothing, leaving external pressure as almost the sole force restraining expansion. It appears that the coefficient of expansion of a gas is nearly independent of the external pressure, for though a greater pressure tends to restrain expansion more, the greater crowding of the molecules resulting from this pressure causes more frequent blows among the molecules, and makes the expansive force increase in nearly the same proportion as the external pressure. This law is not perfectly complied with because the molecules in a gas are not quite free from cohesion, especially when much compressed, and because the diameter of the molecule is an appreciable fraction of the distance between two molecules. Another law, fulfilled only approximately for the same reasons, is that all gases have the same coefficient of expansion, as will be seen in the following table, which gives the cubical coefficient referred as a standard to the volume the gas has at 0° C.

COEFFICIENTS OF CUBICAL EXPANSION OF GASES AT ATMOSPHERIC PRESSURE.

Air..............	0.003667	Carbon monoxide	0.003667
Hydrogen........	0.003662	Carbon dioxide .	0.003726
Nitrogen.........	0.003668	Sulphur dioxide.	0.003845
Oxygen..........	0.003668		

The Convection of Heat.— When the air in contact with a hot stove becomes warmed, it expands and grows lighter than the other air. Owing to unbalanced forces the hot air rises to the ceiling and then spreads out to the walls. It there becomes cooled and therefore contracts and becomes dense. As a result it descends at the walls and finally returns to the stove only to start again on the journey. During this process, called *convection*, heat is carried by the air from the stove to the most distant parts of the room. Winds consist of convection currents in the atmosphere. Some parts of the earth's surface become more highly heated by the sun than others. The air over the hot areas expands and becomes specifically lighter than the surrounding air. The general result is that the hot air is forced to rise, giving place to the surrounding cooler air, which blows toward the hot area as a surface wind. The hot air risen aloft spreads away toward the cool regions as an upper wind. Corresponding to the ascent of air over the hot areas is a descent of air over the cool areas. Much heat is brought from the tropical regions to temperate regions by regular winds.

Convection phenomena also occur in liquids. A large vessel of water supplied with heat at one side of the bottom becomes through the action of convection currents uniformly heated throughout. Much heat is conveyed from the equator toward the poles by means of the Gulf Stream and other ocean currents. It is probable, however, that with ocean currents differences of temperature have little to do with the motion of the water, but that the motion is caused chiefly by the action of winds that blow with great steadiness in a westerly direction across the equatorial portions of the great oceans. Difference in salinity of the ocean at different latitudes may possibly be a partial cause of the phenomenon.

Thermometry.— Before proceeding further in the discussion of heat phenomena, it will be necessary to describe some of the methods employed for measuring temperature or the degree of hotness of a body. Most commonly the methods depend upon the property of expansion. In ordinary thermometers the expanding body is either mercury or colored alcohol. The liquid, say mercury, is held in a glass tube having a fine bore and at one end a spherical or cylindrical bulb, the other end being simply closed. Above the mercury, which fills the bulb and part of the stem, is a space that is free from air and contains only a small amount of mercury vapor. When the thermometer is warmed, the mercury rises in the tube because the cubical expansion of mercury is greater than the cubical expansion of glass. The glass tube is provided with a scale, sometimes engraved directly on the tube, and sometimes engraved on some other material and mounted at the back of the tube. For a Fahrenheit scale, division number 32 is placed opposite the mercury level when the thermometer is placed in pure crushed melting ice, and division number 212 is placed opposite the mercury level when the thermometer is placed in saturated steam over boiling water. As the temperature of the boiling point depends upon the atmospheric pressure, which is ever varying, the standard boiling point is taken to correspond to the average atmospheric pressure, which is measured by a barometric column of 760 millimetres. The space between these marks, the freezing and boiling points, is divided into 180 equal divisions, and then divisions equal to these are extended above the boiling point and below the freezing point. For the Centigrade scale, which is generally employed in scientific work, the freezing point on the thermometer is marked 0° and the boiling point 100°. For the Réaumur scale, much used for household purposes in Germany, these points are marked 0° and 80° respectively, and finally for the De Lisle scale, which is used in Russia, the direction of the graduation is reversed, the boiling point being marked 0° and the freezing point + 150°. With this last thermometer, the greater the intensity of the *cold* the higher the number representing the temperature. Mercury thermometers permit of the measurement of rather high temperatures, mercury not boiling until the temperature of about 357° C. (674.3 F.) is reached. Still higher temperatures with mercury thermometers may be reached by checking the vaporization of the mercury through the introduction into the upper part of the tube of a compressed gas, such as nitrogen. With such a thermometer the only limitation is the softening of the glass at high heats, and even this trouble is largely lessened by the use of vitrified quartz for the material of the bulb. On the other hand, mercury freezes at about — 39° C. (— 38.2° F.) and so becomes useless for indicating temperatures lower than this. For these lower temperatures alcohol may be employed as the thermometric substance because it resists freezing until temperatures far below any met with in nature are encountered. In addition to this advantage alcohol expands much more rapidly than mercury, thus permitting a much larger bore for the same length of degree. However, for very high temperatures alcohol is not available, as it boils at the moderate temperature of 78.3° C. (173° F.).

In practical work thermometry fairly bristles with errors. For several months after a thermometer is made the bulb gradually shrinks, probably owing to some molecular instability in the glass caused by the excessive heating employed in the process of blowing the bulb. This causes the thermometer to read too high. After each time a thermometer is used for a very high temperature the bulb on cooling fails to contract promptly to the volume proper to the new temperature, and so now the thermometer for a while reads too low; however, prolonged heating at the temperature of boiling mercury tends to put the glass into a more stable state. Also such troubles are much reduced by the use of hard glass instead of soft glass for the bulbs. Errors also arise from the following causes: non-uniformity of the bore; variations of atmospheric pressure, which cause a yielding of the bulb; failure to have the stem of the thermometer at the same temperature as the bulb; the hydrostatic pressure on the bulb due to the liquid being tested, especially when the thermometer is sunk to great depths; a variation in the internal pressure of the mercury itself on the bulb when the thermometer is inclined from the vertical position to the horizontal; a peculiar jerking motion of the mercury when it ascends a very fine bore; the fact that equal volumes of the bore marked off on the tube do not represent equal expansions of the mercury, since at high temperatures the volume of the bore indicating a degree has increased (this is quite distinct from the matter of the relative expansion of glass and mercury); irregularities in the expansion of the glass of the thermometer; and lastly irregularities in the expansion of the fluid itself, be it mercury, alcohol, air or any other substance. This last source of error is worth much consideration because two thermometers otherwise perfect but containing different liquids, as alcohol and mercury, fail to agree in their indications. Further, we have no right arbitrarily to select any particular fluid as a standard and yet feel that our temperature scale has anything more than an empirical value. It will, however, be explained in the last section how a theoretical definition for temperature measurement can be formulated (the thermodynamic scale), agreeing fairly with ordinary thermometers, very closely with the hydrogen or nitrogen thermometer, and perfectly free from ambiguity.

In the hydrogen thermometer advantage is taken of the increase of pressure of a gas attending an increase of temperature, the volume of the gas being kept constant. The hydrogen is confined in a glass bulb about two inches in diameter which is connected by a thick-walled capillary tube with the top of one side of a U-shaped apparatus consisting of two vertical glass tubes connected by a rubber hose at their lower ends and partly filled with mercury. When the hydrogen in the bulb is warmed it tends to expand and push the mercury down its side of the U and to cause it to rise on the other side, which is open to the atmosphere. This effect is counteracted by raising the glass tube on the open side, the rubber tubing allowing this to be done. The extra back pressure of the mercury forces the hydrogen back to its former volume. In measuring the pressure to which the hydrogen at any time is subjected, the difference in level of the mercury columns must have added to it the length of the barometric column measured at the time. For each degree Centigrade added to the temperature, the hydrogen is found to increase in pressure about 1/273 of its pressure measured at 0° C. Similarly for each degree subtracted, the pressure decreases 1/273 of the pressure at 0° C. If this law held to the limit, we would conclude that at —273° C. the hydrogen would lose all its pressure, thus indicating the cessation of all molecular motion — a veritable absolute zero of temperature. However, at extremely low temperatures the perfect working of this law is interfered with through the dominance of cohesion which reduces unduly the pressure of the hydrogen, and may cause it to assume the liquid or even the solid state. Nevertheless, this limiting temperature as predicted by the hydrogen thermometer agrees almost exactly with the true absolute zero of the thermodynamic scale referred to above. On this absolute scale the temperature of freezing water is approximately +273° Abs., and temperature of boiling, +373° Abs.

Other methods of measuring temperature depend upon change in the electrical resistance of platinum, and upon the electromotive force created when the juncture of two dissimilar metals, as platinum and rhodium, is heated. Very high and very low temperatures may be measured by such methods.

Conduction of Heat.— When a sterling silver spoon is placed in a cup of hot tea, the handle of the spoon soon becomes uncomfortably warm to the hand. Heat has been conducted through the silver. The molecules in the bowl of the spoon are the first to have their motion accelerated by contact with the tea. This extra motion is communicated to their neighbors which in turn pass it on until, step by step, the motion reaches the molecules in the handle. It appears that in some substances the character of connection between the molecules is more favorable to conduction than in others. As we might have expected, from the close crowding of the molecules found in solids, that class of bodies furnishes the best conductors; but in gases, in which the molecules are very loosely distributed, we naturally find the poorest conductors. Liquids as conductors occupy a position intermediate between solids and gases. Metals surpass all other materials in conducting power, silver standing at the very head of the list, while near the foot of the list of solids are found organic materials and mineral substances, especially when in the porous or fibrous state, such as horn, leather, magnesia brick, asbestos fibre, sand, cotton wool, cowhair felt and down. Great value is attached to poor conductors of heat. They are called insulators. Bone is used in joining the handles to silver teapots. Our clothes are made of organic material woven so as to leave a multitude of fine pores, a condition favorable to insulation and met with in the fur of animals and in the feathers of birds. Sawdust and mineral wool for the same reason are made to serve as insulators of heat in the outer casing of ice boxes.

In the following table of conductivities the better conductors have the higher numbers. These numbers, called the *coefficient of conductivity*, indicate the amount of heat energy measured in calories (a *calorie* is the amount of heat energy required to raise the temperature of a gram of water 1° C.) conducted from one face to the opposite face of a centimetre cube of the substance when one of the faces is maintained one degree hotter than the other. The amount of heat energy conducted is proportional to the difference in temperature between the opposite faces.

COEFFICIENTS OF CONDUCTIVITY.

	Degrees Cent.			
Aluminum at..	18	0.480	Marble.........	0.0050
" .	100	0.492	Carborundum, powdered.....	0.0005
" .	200	0.55	Sand (white, dry)	0.0009
" .	400	0.76	Fire brick......	0.0011
" .	600	1.01	Magnesium carbonate.......	0.00023
Bismuth......	18	0.019	Glass, soda.....	0.0017
"	100	0.016	Cork, ground...	0.00015
Brass.........	0	0.225	Ice.............	0.0057
Constantan...	18	0.054	Leather (cowhide)	0.0004
Copper.......	18	0.918	Asbestos fibre..	0.00019
Iron..........	18	0.144	Paraffin........	0.00023
Lead.........	18	0.083	Water..........	0.00144
Silver........	18	1.006	Olive oil........	0.00040
Zinc..........	18	0.265	Air.............	0.000052
Mercury......	18	0.0153	Carbon dioxide..	0.000031
Fir along grain....		0.00047	Hydrogen......	0.000327
Fir across grain...		0.00026	Wool..........	0.000054
Ebonite..........		0.00037		
Slate.............		0.0036		
Granite..........		0.0053		

Specific Heat.— In the last section the expression "heat energy" was employed, and the "calorie," its unit, was defined. If thin glass vessels containing equal weights at equal temperatures of different materials, mercury and water for example, be placed over equal gas flames so as to receive in a given time equal amounts of heat energy (equal numbers of calories), it will be found that the water will require nearly 30 minutes to get as hot as the mercury does in one minute. The water is said to have a greater capacity for heat than the mercury has. Making allowance for the heat capacity of the glass vessels and for radiation and conduction it is found that the heat capacity of mercury is 0.034 that of water. We say that the *specific heat* of the mercury is 0.034, for water is taken as the standard and to its heat capacity is assigned the value 1.0. The value of the specific heat of a number of solids and liquids is given in the following tables:

SPECIFIC HEAT OF SOLIDS.

SUBSTANCE	A Atomic weight	B Specific heat	C=A×B Atomic heat
Aluminum..............	27.1	0.2111	5.72
Bismuth..............	208.0	0.0298	6.20
Copper..............	63.57	0.0923	5.87
Gold..............	197.2	0.0316	6.23
Iron..............	55.84	0.1117	6.24
Lead..............	207.2	0.0308	6.38
Nickel..............	58.68	0.1078	6.32
Platinum..............	195.2	0.0316	6.17
Silver..............	107.88	0.0559	6.03
Sulphur..............	32.06	0.1844	5.91
Tin..............	118.7	0.0545	6.07
Zinc..............	65.37	0.0927	6.05
Ice..............	....	0.502	....
Paraffin..............	....	0.694	....
Glass, crown..............	....	0.161	....
Wood..............	....	0.687	....
Quarts..............	....	0.187	....
Rock salt..............	....	0.219	....
Gypsum..............	....	0.26	....
Ruby..............	....	0.20	....
Brass..............	....	0.093	....

SPECIFIC HEAT OF LIQUIDS.

Water.........	1.00	Ether................	0.529
Acetone........	0.53	Glycerine.............	0.576
Alcohol, ethyl..	0.548	Mercury..............	0.0332
Benzol.........	0.340	Carbon disulphide.....	0.24
Bromine.......	0.107	Turpentine, spirits.....	0.411

In the first table the atomic weights (the weight of the atom as compared with the weight of an atom of hydrogen) of some of the elements in the solid state are also given. The product obtained by multiplying the specific heat by the atomic weight is given in the last column. It will be observed that these products are approximately equal. This equality indicates that if we took as our standard of comparison equal numbers of atoms of a solid instead of equal weights, all elements in the solid state would have the same heat capacity. It takes about as much heat energy to raise the temperature of an atom of gold one degree as it does for one atom of aluminum. This law of Dulong and Petit also applies with some degree of approximation to compounds in the solid state — not equal heat capacity for the molecules, but for the atoms.

In the cases of gases we have two specific heats according as, on the one hand, the gas is confined to constant volume while being heated, or as, on the other hand, the gas is allowed to expand so as to keep the pressure constant. This is shown in the accompanying table, where it will be seen that the specific heat at constant pressure is greater than the specific heat at constant volume.

SPECIFIC HEATS OF GASES.

SUBSTANCE	Symbol	Constant volume equal weights	Constant pressure		Ratio of specific heats, equals col. 4 ÷ col. 3
			Equal weights	Equal volumes	
Air............	....	.1692	.2374	.2374	1.403
Mercury vapor..	Hg	....	....	....	1.666
Argon..........	Ar	....	....	....	1.63
Carb. monoxide.	CO	.1746	.24	.2370	1.403
Oxygen.........	O_2	.1542	.2174	.2405	1.41
Hydrogen.......	H_2	2.417	3.4090	.2359	1.41
Nitrogen.......	N_2	.1729	.2438	.2370	1.41
Chlorine.......	Cl_2	.0913	.1210	.2962	1.336
Carbon dioxide..	CO_2	.1654	.2169	.3307	1.311
Ether..........	$C_4H_{10}O$	.467	.4810	1.2296	1.03

This difference in specific heat in the same gas is due to two causes. When the gas expands, not only do the molecules acquire greater kinetic energy, but in pushing each other farther apart against the attractive force of cohesion, they require a further amount of energy of the potential sort, and in pushing back the restraining pressure of the atmosphere still another large supply of energy is needed. It appears from several independent considerations that in gases far removed from their liquefying points the cohesion effect is exceedingly small, and so we conclude that the excess of specific heat of an expanding gas is almost entirely due to work done on the external pressure applied to the gas.

In the last column of the table the ratio of the two specific heats of the gases is given. This ratio is found to vary, decreasing from simple gases like mercury vapor, the molecules of which have single atoms, to complex gases like ether vapor, the molecules of which have 15 atoms. With complex molecules a large part of the energy is internal, much being stored up in the rotating motion of the individual molecules, and in the relative motion of their atoms, leaving the energy of translation of the molecules and the energy due to the pushing back of the external pressure about the same as for mercury vapor. It follows then that the energy associated with the external pressure is a smaller fraction of the whole energy, and that therefore, as observed, the ratio between the heat energy imparted to an expanding gas and the heat energy imparted to a non-expanding gas must be smaller for such complex molecules. The value of this ratio is the principal means of judging of the number of atoms in a molecule of an element in the gaseous state.

Before leaving this subject it should be remarked that the specific heat of water varies slightly with the temperature, and so it is convenient to take as the value of the calorie one hundredth of the heat energy required to raise the temperature of a gram of water from 0° C. to 100° C.

Latent Heat.— If heat energy be imparted to a mass of ice at the point of melting, the ice will proceed to melt, but will not grow any warmer as it does so. The heat energy thus added without increasing temperature is called *latent heat.* Latent heat is devoted only to shaking the molecules of ice asunder, not to increasing their speed. Temperature depends upon the energy of motion (kinetic energy) of the molecules; latent heat only stores up energy of position (potential energy) of the molecules, and so does not produce an increase of temperature (this simple statement must be modified in cases of change of polymerization). Again, when water is being boiled, a large amount of heat energy becomes latent. The latent heat of vaporization and of melting for a variety of substances is given below.

LATENT HEAT OF VAPORIZATION.

	Calories		Calories
Water	536	Mercury	62
Acetone	126	Carbon disulphide	90
Ethyl alcohol	206	Sulphur	362
Methyl alcohol	264	Ether	91
Liquid air	47		

LATENT HEAT OF MELTING.

	Calories		Calories
Ice	80.	Silver	21.07
Sulphur	9.37	Mercury	2.82
Paraffin	35.10	Iron	35.
Phosphorus	5.	Platinum	27.
Bees-wax	42.	Tin	14.
Zinc	28.13	Bismuth	13.
Lead	5.36	Copper	42.

It should be remarked that the latent heat devoted to converting a liquid into vapor, besides increasing the internal potential energy of the molecules, also does work in pushing back the atmosphere, but with water this external work bears a very small ratio to the internal work against cohesion, namely, a little more than one-twelfth.

Heretofore we have supposed the energy for melting or for vaporization to be derived from some external source of heat. It is, however, possible to secure a change of state through the consumption of the heat energy of the body itself. If water be left in an open vessel it will presently have evaporated entirely away. During the progress of this vaporization a thermometer placed either in the water or in the moist air above the water will show a temperature lower than that of the surrounding air. The reason of this is as follows: At the surface of the liquid, with all the irregularities of position and velocity possessed by the molecules, some of them find opportunity to fly off from the liquid surface. On the average it will be the faster going molecules that spring away first, thus leaving the more slowly going ones behind, which is the same as saying that the remaining liquid is cooler. Also in going away, the molecules fly against the back pull of cohesion, and so their velocity is checked. Indeed many are entirely stopped and drawn back into the liquid, though others escape quite beyond the range of cohesion of the liquid and diffuse among the molecules of the air. The reduced motion of these escaping molecules causes the low temperature, referred to above, of the vapor. Common illustrations of cold by evaporation are frequently met with. The function of perspiration is a means of regulating the temperature of the human body. In the healthy state when we are overheated the skin becomes very moist, and the evaporation of this moisture, assisted by a breeze or by fanning, cools the surface. In disease the proper action of the skin may be interfered with, and becoming dry, may fail through lack of evaporation to provide the normal cooling effect. An exalted temperature of the body ensues; in other words, a fever. Certain drugs tend to promote perspiration and thus reduce the temperature of the patient. Another large factor in the temperature regulation of the body is in the water evaporated from the lungs in the process of breathing. The evaporation of ammonia that has been liquefied by pressure furnishes the cold employed in some ice machines. In the case of liquefaction the necessary latent heat may be derived from the body itself. This occurs when a salt is dissolved in water, a process that is generally accompanied by a fall of temperature, though occasionally a rise in temperature is noted. The factors governing the result in such cases are rather complicated. We have to take account of the work done by the solvent in tearing molecules away from the solid lump and in some cases the tearing of these molecules apart into electrically charged parts called ions. On the other hand a certain amount of kinetic energy is furnished by the attraction of the molecules of the dissolving substance by the molecules of the solvent. According as the back pulls or the forward pulls predominate, will the temperature of the solution tend to be lowered or raised. If much chemical combination takes place between the substance and the solvent, the solution is almost always warmed.

There is another reason why ionization tends to cool and chemical combination tends to warm a body; it is because of the increase or decrease in the mere number of separate particles. For temperature depends upon the average kinetic energy of the particles or molecules, small particles at a given temperature making up in speed for what they lack in mass. An increase in the number of particles involves, if no heat is added from the outside, a subdivision of their energy, a smaller average energy, and, hence, a lower temperature. When particles combine, their energies combine also, and so there is an increase in their average energy and a like increase in their temperature.

The temperature at which melting takes place depends upon external pressure. With a solidlike paraffin, which expands on liquefying, high pressure, which resists expansion, stops melting until a temperature slightly higher than the ordinary melting point is reached. Paraffin that under ordinary conditions melts at 46.3° C. melts at 49.9° C. when subjected to the additional pressure of 100 atmospheres. In the case of ice, which contracts on melting, melting is favored by pressure. The addition of one atmosphere of pressure lowers the melting point of ice by 0.0072° C. This fact accounts for the slipperiness of ice, especially when being skated upon. The sharp edge of the skate exerts great pressure on the ice below it, which melts and furnishes a lubricating film of water. This film of water is cooler than the ice furnishing it, some of the heat of the ice having become latent, and as soon as the skate has passed over, the water immediately resumes the solid state. This process of freezing again is called *regelation*. Regelation is an important factor in glacier motion. The ice as it follows down a tortuous valley is continually being cracked. After the settling following this cracking, the great pressure from the upper ice fields melts the ice at the points of contact of opposite sides of a fracture, and the escaping undercooled water freezes again, thus healing the fracture. In this way the glacier appears to follow down the irregularities of a valley as would a very viscous mass.

MELTING POINTS.

	Deg. Cent.			Deg. Cent.
Aluminium	658	Paraffin		52
Antimony	630	Bees'-wax		63
Bismuth	270	Ice		0
Cadmium	321	Silver chloride		450
Copper	1083	Fluorspar		900
Gold	1063	Potassium nitrate		340
Iron, pure	1530	Salt, common		800
Iron, cast	1150	Sugar, crystals		170
Lead	327	Lead 30%	Alloy	185
Mercury	—38.7	Tin 70%		
Nickel	1452	Lead 32.0%	Alloy	96
Platinum	1755	Tin 15.5%		
Ruthenium	2450	Bismuth 52.5%		
Silver	961	Lead 24.9%	Alloy	65
Tantalum	2850	Tin 14.2%		
Tin	232	Bismuth 50.1%		
Tungsten	3200	Cadmium 10.8%		
Carbon vaporizes at	3600	Copper 60%	Brass	900
Sulphur	114	Zinc 40%		

Saturated and Unsaturated Vapors.—When a liquid, water for example, is placed in a vacuous enclosure kept at constant temperature by artificial means, it immediately begins to evaporate, the vapor presently attaining a maximum density and pressure. The vapor as well as the space occupied by it is then said to be *saturated*. Before this maximum pressure was reached the vapor was unsaturated. If the temperature of the whole apparatus be now raised, more water will commence to evaporate, and the vapor will increase in density and pressure before it is again saturated. Had the saturated vapor formed in the first place been shut off from the water surface before raising the temperature, it would not become as dense as when it had the water evaporating into it, and so we would then pronounce the heated saturated vapor as *unsaturated*. On the other hand, if a mass of unsaturated water vapor be cooled, the density of the vapor will at a certain temperature be sufficient to cause saturation. Below this particular temperature, called the *dew-point*, some of the moisture will condense. In some cases, however, when there are no nuclei in the form of dust particles, free ions, etc., the vapor may cool appreciably below the dew-point without immediate condensation. The vapor is then said to be *supersaturated*. The presence of air has only a very small influence on the density and pressure of saturated water vapor in contact with water, especially when the temperature is not high.

When the temperature of water or other volatile liquid is raised so high that the pressure of the saturated vapor becomes as great as that of the atmosphere, bubbles of the vapor begin to form in the body of the liquid. This constitutes the process of boiling. The temperature at which a liquid boils is much influenced by the external pressure. The boiling point is the same as the temperature at which the pressure of the saturated vapor equals the external pressure on the bubble. In the following table these temperatures with their corresponding pressures are given for water.

PRESSURE OF WATER VAPOR.

Temperature degrees Centigrade	Pressure in millimetres of mercury	Temperature degrees Centigrade	Pressure millimetre centigrade
—60	0.008	50	92.54
—50	0.029	60	149.46
—40	0.094	70	233.79
—30	0.280	80	355.5
—20	0.770	82	385.2
—10	1.947	84	417.1
0	4.579	86	451.1
+5	6.543	88	487.3
10	9.210	90	526.0
15	12.790	92	567.2
20	17.539	94	611.0
25	23.763	96	657.7
30	31.834	98	707.3
35	42.188	99	733.2
40	55.341	100	760.0
45	71.90	101	787.6

Degrees Centigrade	Pressure in atmospheres	Degrees Centigrade	Pressure in atmospheres
100.	1	198.8	15
112.2	1½	201.9	16
120.6	2	204.9	17
133.9	3	207.7	18
144.0	4	210.4	19
152.2	5	213.0	20
156.2	6	215.5	21
165.3	7	217.9	22
170.8	8	220.3	23
175.8	9	222.5	24
180.3	10	224.7	25
184.5	11	226.8	26
188.4	12	228.9	27
192.1	13	230.9	28
195.5	14		

A saturated vapor in contact with its liquid offers a beautiful instance of dynamic equilibrium. We conceive that molecules are ever leaving the surface of the water, adding themselves to the vapor. At the same time molecules of the vapor coming near to the liquid surface or plunging into it are caught by the cohesion of the liquid, thus subtracting themselves from the vapor. A less dense vapor would lessen the latter process and would allow the vapor to grow denser; a denser vapor would increase it and allow the vapor to fall to a state — the saturated state—when the rate of evaporation is just equal to the rate of condensation.

BOILING POINTS OF LIQUIDS.

	Degrees Cent.		Degrees Cent.
Hydrogen	—252.6	Chloroform	61.2
Helium	—267.	Alcohol, methyl	66.
Nitrogen	—195.	Carbon tetrachloride	76.7
Argon	—186.1	Alcohol, ethyl	78.
Oxygen	—182.7	Benzol	80.2
Krypton	—151.7	Nitric acid	86.
Neon	—239.	Water	100.
Fluorine	—187.	Amyl acetate	150.
Zenon	—109.1	Aniline	183.9
Ethylene	—102.	Sulphuric acid	338.
Nitrous oxide	—89.	Sulphur	444.7
Carbon dioxide sublimes	—80.	Mercury	357.
Chlorine	—33.6	Sodium	750.
Ammonia	—33.5	Zinc	930.
Sulphur dioxide	—10.1	Silver	1955.
Ether	34.6	Copper	2310.
Carbon disulphide	46.2	Iron	2450.
Acetone	56.1	Carbon sublimes at	3600.

The degree of moistness of air is expressed by the phrase *hygrometric state*. The hygrometric state does not express the density of the water vapor present, but, instead, expresses the quotient obtained by dividing the density of the vapor present by the density of the vapor required to saturate the air. If pressures were employed instead of densities in getting the quotient, substantially the same result would be obtained. Still another common way of defining hygrometric state is to take the quotient obtained by dividing the pressure of the vapor corresponding to the dew-point by the pressure of vapor saturated at the temperature of the air, a method closely agreeing with the former ones.

The Critical State.— When the temperature rises, the saturated vapor in contact with its liquid becomes denser, while the liquid itself expands and becomes less dense. If the heating of the liquid and vapor takes place in a strong closed vessel containing not too much or too little of the liquid, after a while a temperature is reached at which the saturated vapor becomes as dense as the liquid. At this point they become identical in their physical properties; the line of demarcation of liquid and vapor fades away, and the two fluids begin to mix. The temperature at which this phenomenon occurs is called the *critical temperature;* the corresponding pressure and density are called the *critical pressure* and *critical density,* and the liquid is said to be at the *critical state.* Above the critical temperature it is impossible to distinguish between a liquid and its vapor. No matter how great the pressure, a gas or vapor cannot be forced into the state of a liquid that is obviously distinct from the vapor unless the vapor be cooled below the critical temperature.

CRITICAL TEMPERATURES, PRESSURES AND DENSITIES.

SUBSTANCE	Critical temperature in degrees Centigrade	Critical pressure in atmospheres	Critical density relative to water
Helium	—268.0	....	....
Hydrogen	—240.8	14	....
Neon	—205.0	29	....
Oxygen	—118.0	50	0.604
Nitrogen	—146.0	35	0.44
Carbon monoxide	—141.1	35.9	....
Argon	—117.4	52.9	....
Fluorine	—121.0	50.6	....
Methane	—95.5	50	....
Carbon dioxide	+31.2	73	0.46
Ammonia	130.0	115	....
Sulphur dioxide	155.4	78.9	0.49
Chlorine	141.0	83.9	....
Nitrous oxide	35.4	75	....
Water	374.0	217.5	0.429
Ethane	32.1	49	....
Ethylene	9.9	51.1	....
Ether	194.4	35.61	0.262
Krypton	—62.5	54.3	....

Radiation.—We have described two methods by which heat energy may be transferred from one place to another — by conduction and by convection. A third method remains to be studied. How does the heat of the sun reach us? By means of waves in the luminiferous ether. Go to a quiet pond in which a piece of wood may be floating. Standing on the shore, vibrate your hand up and down in the water. Waves run from your hand over the surface of the water to the wood and cause it to vibrate up and down. Energy from the hand has been transferred to the wood by means of waves. These waves consist of the successive vibration of successive particles of water, each particle receiving energy from behind and passing it on to the front. It is much the same with heat waves. The ether, which fills all space, is capable of being set into vibration by vibrating molecules and of handing this vibration on step by step in the form of waves. Molecules acted upon by these waves are themselves set into vibration. The vibrating molecules of the sun generate ether waves, and the ether waves generate vibration of the molecules of bodies on the earth. These ether waves are called *radiant heat.* We now have a very wide range of ether waves under experimental control. From the large waves generated by electrical oscillations used in wireless telegraphy and sometimes several miles long we may pass by insensible gradations, with only two breaks, to the extremely minute waves which constitute Röntgen's X-rays and the Gamma rays of radium. Dark heat waves, or infra-red rays, ordinary light and ultra-violet light belong to the middle of the series. The shortest electrical waves thus far tested are about one-tenth of an inch long, while the length of the longest heat waves is about 1/300 inch. The shortest ultra-violet waves are about 1/300,000 inch long. All ether waves have the same velocity as light, namely, 186,300 miles a second. All may be reflected, refracted, polarized, diffracted, and made to interfere. They may be absorbed by transmission to a degree depending upon the substance used for transmission and the particular wave-length of the rays.

Thermodynamics.—The most cogent reason for discarding the caloric theory of heat is that heat may be generated from that which is not in any sense substance — heat may be derived from mechanical energy. Heat is generated when a brass button is rubbed on the carpet, when a bullet is struck with a hammer, and when two pieces of ice are rubbed together, a process resulting in their melting. The relation between mechanical energy and the heat energy generated by its consumption was first carefully investigated by J. P. Joule before 1850. One pound calorie of heat energy is obtained from 1,399 foot-pounds of mechanical energy. That is to say, the energy due to the fall of 1,399 pounds through the distance of a foot is sufficient if transformed into heat to raise the temperature of a pound of water through one degree centigrade. This number of foot-pounds is called the *mechanical equivalent of heat,* for it has been found that the process is reversible. When by means of an air-engine or a steam-engine one pound calorie of heat is consumed in generating mechanical energy, 1,399 foot-pounds of the latter are obtained. *The first law of thermodynamics* states that when mechanical energy is converted into heat, or when heat is converted into mechanical energy, the quantity of mechanical energy is equivalent to the quantity of heat energy. *The second law of thermodynamics* states that it is impossible for a machine without the consumption of external energy to make heat pass from a body at a low temperature to one at a high temperature. However, when mechanical energy is supplied, such a transfer of energy from a cold body to a hot body becomes possible through the use of a «reversible engine.» A heat engine is «perfectly reversible» when a reversal of its cycle of operation is attended by a reversal of all its energy changes, in kind and in amount. Thus, during a direct cycle in a hot air engine, an amount of heat energy, H, is taken from a high temperature «source» and partly converted into an amount of mechanical energy, W, and partly transferred as an amount of heat energy, H′, to the low temperature «escape.» Here $W = H + H'$, assuming these quantities to be measured in the same equivalent units, such as foot-pounds. Now, when the hot air engine is reversed in motion by the external application of the same amount of mechanical energy, W, it will, if perfectly reversible, take, during one complete reversed cycle, the amount, H′, of heat energy from the low temperature escape and, combining with it the mechanical energy, W, deliver to the high temperature source a quantity of heat energy equal to H. Of course, the perfect reversibility here supposed is a theoretical ideal to which practical engines only approximate. The ratio of the mechanical energy generated in a perfectly reversible engine to the heat energy drawn from the high temperature source, i.e., the ratio of W to H, is dependent upon the temperature of the source and the temperature of the escape. This ratio, sometimes called the *thermodynamic efficiency* of the engine, must, in the case of perfect reversibility, be absolutely independent of the construction of the engine and of the nature of the working substance, be it air, steam, ether vapor, liquid or solid. For, following Carnot, if we suppose that there could be two perfectly reversible engines working between the same hot body as a source and the same cool body as an escape but with different thermodynamic efficiencies, we can imagine that these two engines are coupled together in such a way that the more efficient engine, working directly, will drive the less efficient engine, working reversely. The result of this combination would be that more heat energy would pass from the cool escape up to the hot source than would pass from the hot source down to the cool escape. In other words, with a self-contained device not employing external energy we would thus succeed in making heat pass from a body at a low temperature to a body at a high temperature, which is contrary to the second law of thermodynamics. The thermodynamic efficiency of a perfectly reversible engine is, then, dependent *only* upon the two extreme temperatures between which it works. In good practical condensing steam engines, which, of course, are only imperfectly reversible, the thermodynamic efficiency may occasionally exceed 20 per cent. This means that 20 per cent of the heat energy supplied to the engine from the boiler is converted into mechanical energy, the remaining 80 per cent escaping partly, as it should, at the condenser and partly, as it should not, by conduction, radiation, etc. This thermodynamic efficiency may be as much, in a good practical steam-engine, as 70 per cent of the thermodynamic efficiency of an ideal engine working between the same boiler temperature and the same condenser temperature.

Using the provisional absolute scale as indicated by a hydrogen thermometer, experiment shows that the ideal efficiency, W/H, of a perfectly reversible engine, is *roughly* represented by the following equation in which W stands for the mechanical energy realized, H for the heat (measured in the equivalent foot-pounds) leaving the high temperature source, T for the temperature of the source, and T^1 for the temperature of the cooler escape.

$$\frac{W}{H} = \frac{T - T^1}{T}$$

This suggests a new definition for a temperature scale, namely, that numerical values of temperatures be so adjusted as to fulfil *exactly* the above formula. Since the formula only fixes a ratio between the temperatures T and T^1 corresponding to a given efficiency, an infinite number of sets of numerical values for these temperatures could be found to satisfy the formula. But if it be decided that a definite numerical range, say 100 degrees, be comprised between the freezing and boiling points of water, only one set of values become possible. This decision makes the value of the freezing point very nearly +273° Abs., and the value of the boiling point +373° Abs. Lord Kelvin was the first to propose this *thermodynamic scale.* Theory shows that its indications would correspond exactly to a thermometer containing a perfect gas. Hydrogen is not quite a perfect gas, for its molecules attract each other slightly and they occupy an appreciable fraction of the space holding the gas. Hence there are small deviations of the hydrogen thermometer from the thermodynamic scale, especially at low temperatures. In spite of these difficulties much progress in the realization of the thermodynamic scale has been achieved through ingenious mathematical considerations relating to two sets of experimental observations: those made by Regnault on the expansion and on the increase of pressure of hydrogen and other gases when heated, and those made by Joule and Kelvin on the temperature changes suffered by gases in passing through a porous plug. Nevertheless, the thermodynamic scale offers us a theoretical ideal which is independent of the thermal properties of any particular substance, but is only related in a definite way to a fixed universal law.

When a *small* amount of heat is transferred from or to a gram of a substance, the heat transferred (measured in calories), divided by the average absolute temperature of the substance at the time of the transference is called the *change of entropy* of the substance. For convenience, the zero of entropy is generally taken to correspond to water at the freezing point and under the normal atmospheric pressure. It may be shown that when two bodies at different temperatures are placed in contact and their temperatures become equalized, the average entropy rises, for from the above definition of entropy, the heat leaving the hotter body must reduce its entropy less than it increases the entropy of the cooler body into which the heat enters. Consequently, as temperature equalizations are always going on, the average *entropy* of the universe is constantly rising and tending toward a *maximum*. At the same time, for the same reason, the *availability* of the heat energy of the universe to be converted into mechanical energy is tending toward *zero*, for this availability depends upon difference in temperature of sources and escapes, and is destroyed by temperature equalization resulting from conduction, radiation and mixing.

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HEAT-BALANCE DIAGRAM. See Internal Combustion Engine.

HEAT ENGINE. See Internal Combustion Engine.

HEATH, Daniel Collamore, American publisher: b. Salem, Me., 26 Oct. 1843; d. 29 Jan. 1908. He was graduated from Amherst in 1868, became a junior member of the firm of Ginn & Heath, publishers, of Boston, and in 1886 established in Boston the house of D. C. Heath & Company, publishers of textbooks for schools and colleges, with branch offices in New York, Chicago and London.

HEATH, Perry Sanford, American journalist and publisher: b. Muncie, Ind., 31 Aug. 1857. He learned the printer's trade, and in 1877 became a newspaper reporter; in 1878 established first daily newspaper at Muncie; in 1881 established first newspaper at Aberdeen, S. D.; was general newspaper correspondent at Washington, D. C., 1881–93. He was president, editor and general manager of the Cincinnati *Commercial-Gazette* (now *Commercial-Tribune*), 1894–96. Was in charge of the literary department of the Republican National Committee in the McKinley campaign 1896. He was First Assistant Postmaster-General 1897–1900, when he developed the present system of free rural mail delivery. He was secretary to the Republican National Committee 1900–04. He purchased the Salt Lake *Tribune* (editor and general manager) 1901; established Salt Lake *Evening Telegram* 1903; disposed of both in 1905. He was incorporator and director of the Salt Lake–Los Angeles Railroad, 1901–03. At present he is an investor in various industrial and commercial enterprises.

HEATH, William, American soldier: b. Roxbury, Mass., 7 March 1737; d. there, 24 Jan. 1814. When the Massachusetts congress in 1774 voted to enroll 12,000 minute men, volunteers from among the militia, Heath, then a farmer in Roxbury, was commissioned as one of the generals. In June 1775 he received the appointment of brigadier in the Continental army, and in August 1776 was created major-general. When the troops moved to New York Heath was stationed in the Highlands near King's Bridge, with orders to throw up fortifications for the defense of that important pass. In 1777 he was transferred to Boston, and the prisoners of Saratoga were entrusted to him. In June 1779 he was again in New York, at the Highlands, with four regiments, and was stationed near the Hudson till the close of the war. He was the last surviving major-general of the war. His 'Memoirs' (1798) and 'Correspondence' (published in the Massachusetts Historical Collections, 1904–05) are full of interest for students of the Revolutionary period.

HEATHCOCK, HEATH-HEN. See Blackcock.

HEATHCOTE, Caleb, American merchant: b. Chesterfield, Derbyshire, England, 6 March 1665; d. New York, 28 Feb. 1721. He was successful in a mercantile career in New York from 1692, save for the years 1698–1701, was a councillor of the province, was a petitioner for a license to build Old Trinity, was mayor of New York in 1711–14, and held other posts, among them those of judge of Westchester County; commander-in-chief of the military of the colony; surveyor-general; and receiver-general of customs for North America. His letters and dispatches afford interesting glimpses of the history of his time.

HEATHS, or **HEATHER,** a group of plants, chiefly of the genus *Erica*, of the family *Ericaceæ*. The leaves of the heaths are simple and entire; their flowers ovoid, cylindrical or even swelled at the base; the anthers of many with horn-like appendages. From 400 to 500 species are known, 12 or 15 of which inhabit Europe, and have small flowers, while most of the remainder are natives of South Africa, many of them bearing brilliantly colored flowers, and forming one of the most characteristic genera of that region of dry plains. The common heath of Europe (*Calluna vulgaris*), a low shrub, often covers exclusively extensive tracts of dry land, and is used in domestic economy; mixed with oak bark it is employed in tanning; and also, when tender, for fodder. This species forms the "heather" of British moorlands; but in Scotland are two other species, whose flowers are the "heather-bells" of Scottish song and story. Many South African species, remarkable for the size and beauty of their flowers, are much cultivated in greenhouses, and have been so improved and hybridized that they exhibit a wonderful richness of color.

HEATING AND VENTILATION. Generally speaking, the methods of heating buildings may be divided into two general classes — the direct and the indirect system, or a combination of the two. Heating by means of an open fire, by a stove and by radiators placed in the rooms to be warmed are examples of the former method, while furnace-heating and heating by means of a current of air warmed by indirect steam or hot-water coils are examples of the latter method. When a direct radiator is fitted with a connection to the outer air, it is said to be arranged on the direct-indirect principle. Hot water, steam or electricity may be the vehicle used for conveying heat to radiators. Ventilation is only obtained by supplying air, and in some systems of heating and ventilation the air is made so hot that part of it is available for heating purposes. This is the case in furnace-heating.

It is well known that when two bodies of different temperature exist, heat passes from the warmer to the cooler body until their temperatures are equal. If a building be of a temperature of 70° F. and the outer air of a lower temperature, heat will be transmitted by the walls, windows and other exposed surfaces, and the temperature of the air in the building will be lowered. It is only by supplying to the building an amount of heat equivalent to that transmitted by the walls and windows that it is possible to maintain the building at constant temperature. If we supply more heat than is transmitted by the walls, the temperature of the room rises.

Heat is measured in units which have as exact a value as a ton of coal or a pound of sugar. British physicists have selected as the unit of heat that quantity which will raise the temperature of one pound of water one degree on the Fahrenheit scale when the water's temperature is near 39° F. This unit is designated as the British thermal unit. It is known with reasonable accuracy just how many heat-units are transmitted by each square foot of wall, window and other exposed surfaces of the various materials used in building construction, under such extreme conditions as to building and outside temperature as may exist. With these data and the plans of a building, calculation will show the heat-loss from a building or a room, and the heating-apparatus should be proportioned to supply this amount of heat. Allowances are made for various conditions that may exist, depending upon the judgment and experience of the designer. The heat required can be supplied by radiation from an open fire or from a stove, but this is an unsatisfactory method. Direct radiators supplied with steam or hot water can be placed in a room to furnish the heat necessary, or the heat may be supplied by hot air from a furnace, or by air heated by indirect radiators supplied with steam or hot water.

Heating by hot air is a slightly more expensive method than heating by direct radiation, for to be effective the air must be taken in from outdoors, sometimes at very low temperature, and heated above the temperature of the room to be warmed. If cold air at 40° F. is heated to 100° F., and is supplied to a room at this temperature, it is evident that as soon as this air is cooled from 100° to 70° no more heat can pass from the air to the room if the temperature of the latter remains at 70°. Under these conditions only one-half of the heat that has been supplied to the air is available for heating the room. This will tend to show why heating by hot air is more expensive, estimated from the cost of fuel, than the direct system. When the advantages of the air supply that accompanies indirect heating are taken into account the increased fuel cost becomes insignificant.

Direct heating is usually obtained by steam and hot-water radiators. Although manufacturers have greatly improved the appearance of direct radiators, at best they are unsightly and objectionable from an artistic point of view. This objection may be overcome by concealing the radiators in boxing beneath windows, when the walls of the building are thick enough to permit the boxing to be built in without projecting into the room. A screened opening is provided in the front of the boxing near the floor, and one at the top over the radiator, to permit a circulation of air, so that the radiators can be effective.

In residence-heating it is frequently the custom to heat the first floor by the indirect method and the upper stories by the direct. When an owner will pay for it, the indirect method is used throughout the building. Such a system is much to be preferred to the direct.

The simplest method of connecting steam-radiators is by the gravity system, and it is usually employed unless steam exhausted by engines is available for heating. This system comprises distributing-mains connecting with the top of the boiler, and with vertical riser-pipes from which horizontal branches lead to the radiators. Usually a return pipe is connected to the opposite end of the radiators from that at which steam is admitted, this return connecting, through return risers and mains, with the boiler at a point below the water-line. As the steam in the radiators condenses, the resulting condensation flows back by gravity through the return pipes to the boiler. The flow and return pipes are made sufficiently large to ensure a practically uniform pressure throughout the system. The system is simplicity itself, as the fire only needs attention. When the boiler is once filled, no more water is required.

It is only recently that the steam exhausted by engines and pumps has been used for heating. Before this time steam direct from the boilers was used in direct radiators for heating mills and factories. The radiators consisted of coils of pipe suspended from the walls or ceilings. Sometimes the condensation was returned to the boilers by a pump or other device; sometimes it was allowed to go to waste. As the steam exhausted by engines, pumps, etc., contains a very large percentage of the heat that it contained upon entering the engine, someone conceived the idea of utilizing this steam for heating buildings, thereby saving the steam direct from the boilers that would otherwise have to be used. This practice is now almost universal where exhaust-steam is available, and the saving that it has occasioned is very great. By placing what is known as a back-pressure valve in the exhaust-pipe, sufficient pressure is maintained to cause the exhaust-steam to circulate through the pipes and radiators of the heating-system, the latter being connected to the exhaust-pipe between the engine and the back-pressure valve. The condensation that occurs in the heating system can be collected and returned to the boilers by various methods. Usually a pump or similarly acting device is employed.

A hot-water system arranged on the gravity-principle has flow and return pipes similar to the gravity-system of steam-heating described. The entire system is filled with water. As the water is warmed in the boilers it becomes lighter in weight per cubic foot, making a difference in pressure between the flow and return pipes and causing a circulation to begin. The water rises in the flow pipes to the radiators and is there cooled. On its return to the boiler the water is again heated, and so the circulation is maintained. As the difference in weight between the water in the flow and return pipes is very slight, the motive power producing the circulation is very slight also. Hence the pipes have to be relatively larger than for steam-heating and very carefully connected to avoid excessive friction, which would stop or retard the circulation. As large pipes are costly, in some large plants heated by hot water, a circulation is brought about by pumps.

Direct steam-radiators emit about 250 British thermal units per square foot of radiating surface per hour, and hot-water radiators about 180 heat-units per square foot. Consequently about one-third more radiating surface is necessary with hot water than with steam. The pipes also must be larger, hence the hot-water system is the most expensive in first cost. Hot water, however, is cheaper to operate, for water will circulate with a very low fire and supply the small amount of heat required to warm a building in mild weather.

With direct steam-heat, operating on the gravity system, it is impossible to vary to any appreciable extent the temperature of steam in a radiator; hence with this system the alternative is all the heat the radiator will supply or none at all. This is the principal objection to heating by means of direct steam. Air warmed by the relatively cooler hot-water radiators is thought by some to be more agrèeable than air heated by steam-radiators.

With indirect heating the lack of means of regulating the steam-temperature is not of so much moment, for the air-supply can be partly shut off by partly closing a register in mild weather; or else, if the full air-supply is required at all times, arrangements can be made for passing part of the air-supply around the indirect radiators, which is called «by-passing» them. Another method is to divide the indirect radiator into independent sections and place some of the sections under the control of a regulator that automatically shuts off the supply of steam when the room becomes too warm. The method of «by-passing» the radiator, or subdividing it, is used mainly with the fan-system of supplying air.

The cost of indirect hot-water heating is greater than that of indirect heating by steam, as the radiators and pipes must be larger, the same as in direct heating. Hot water is, however, cheaper to operate. The principal objection to its use in indirect heating is the possibility of damage to the indirect radiators through the freezing of the water in them in severe weather, if the circulation should from any cause be arrested.

The direct-indirect system consists of direct radiators connected with the outer air by means of an opening in the building-walls beneath the window-sill, the radiator being set under the window opposite the opening. With this system there is always the possibility of getting too much air when the wind blows strongly. Furthermore, in situations where the air is smoke-laden or dusty, it is not easy to keep the smoke and dust from entering a building supplied with air by this means.

As has been said, a supply of air may be brought about by the gravity-method or by means of fans. In the gravity-method the heated column of air in the flue is lighter than the outdoor air; hence it rises. As in the case of hot-water heating, the motive power is very slight, and it becomes less as the outdoor temperature increases. For this reason the gravity system is not a positive one, and it cannot be depended upon to supply much air in mild weather. Its use for schoolhouse ventilation is therefore to be deprecated. An important advantage of this system is its simplicity, as no machinery is required with it.

With the fan-system some type of fan is employed, to give a positive supply of air. The air is blown over coils, usually steam, and delivered to the room at a temperature slightly above that of the room, if the air-supply is intended to ventilate only, or at a higher temperature if the air-supply is to carry with it the heat necessary to balance that transmitted by the walls and windows. In the former event the indirect coils act as tempering-coils, being sufficient only to raise the air to about 70° F. If the air-supply is to furnish heat for warming the rooms, additional coils, known as supplementary coils, are provided. These raise the air-temperature from 70° to from 100° to 120° F. Sometimes the supplementary coils are combined with the tempering coils, the whole being divided into several independently controlled sections. In some instances the supplementary coils are divided into a number of small coils, one being placed at the base of each air-supply flue, and so arranged that, by adjusting dampers controlled by hand or automatically, the temperature of the air supplied to any room can be regulated independently of that supplied to other rooms. If all of the air is passed through one group of coils, independent regulation of the temperature of the air in the branch ducts and flues is impossible. This independent regulation can be obtained, however, by the double-duct system. The coils are divided into two groups, one for tempering and one for supplying additional heat. All of the air is passed through the tempering coils, but only part of it through the supplementary coils, the balance «by-passing» the latter coils and flowing through a system of ducts, usually located below the system conveying the air of higher temperature, to the base of the flues. At the junction of the two ducts a mixing-damper is provided, so arranged as to open in one duct as it closes in the other. By adjusting this damper the air can be mixed to give the resultant temperature required.

In situations where direct radiators can be used, either exposed or concealed, it is becoming the practice to provide sufficient heat by means of direct radiation to balance the heat transmitted by walls, windows, etc., also a supply of tempered air for ventilation only. As previously explained, when heat is supplied by means of air, the fuel-cost is greater than with direct heating; so that a building can be warmed with less coal with the direct than with the indirect system. Furthermore, with the combined system, heating can be done at night, and at other times when air-supply is not required, at minimum cost. This system is particularly adapted for schoolhouse heating and ventilation.

The withdrawal of impure air from rooms is effected by fans connected to a system of vent-flues extending upward to an attic space, or downward to a cellar or basement, if the latter is more convenient. Another method of accelerating the outflow of air through flues rising to the roof of a building is by the use of aspirating coils. These are simply coils of pipe, or radiators, placed in the vent-flues as low down as possible, the coil heating the air and thus causing it to rise. Theoretically the aspirating coil is a more expensive method of moving air than the mechanical method, as far as fuel-cost is concerned. It is simpler, however, than the fan-system.

Fans are of two general types — the disc or propeller fan, and the centrifugal blower. The former is constructed somewhat like a ship's propeller, and the current of air that it produces is mainly in a direction parallel with the shaft of the fan. The centrifugal blower, as usually designed, consists of a wheel with blades, something like a ship's paddle-wheel, enclosed in a casing. The air enters at the axis of the fan, and when the fan-wheel is revolved the air is discharged radially to the casing by the action of centrifugal force. Relatively speaking, the propeller-fan will move a large volume of air with small expenditure of power, but the pressure at which it will deliver air is limited. The centrifugal fan will deliver air under a greater pressure and the power required is therefore greater. In some buildings, where the system is of ducts and flues, is long, and the cross-sections are comparatively small, to save space, quite a pressure is required to force the necessary amount of air through them. For such situations the centrifugal blower is best adapted. When the ducts are short and of ample area, it is best to use the propeller type of fan.

Fans are driven usually by small steam-engines or by electric motors. Sometimes gas-engines have been used with success. Where an engine is used, it is necessary for the boilers to operate under a sufficient pressure to drive the engine, or at least under a higher pressure than is commonly used with the gravity-system of connecting radiators. If the steam exhausted by the engine is condensed in the heating-system, as it usually is, a pump is necessary to return the condensation to the boilers. In large office buildings, public buildings, theatres, etc., where a skilled engineman is employed to care for the plant, the use of a pump, an engine, etc., does not present an objection. On the other hand, in the case of schoolhouses, large residences, churches, etc., which are apt to be looked after by less skilled attendants, an engine, pump and other apparatus that must go with them are open to objection. In such cases electric motors can be used if current can be obtained from an electric-supply company. The entire heating system can then be operated on the simpler gravity system. Of course the current must be paid for, but in many locations its cost will be more than offset by the greater simplicity of the motor-driven system.

One of the most important developments in recent years in connection with ventilation of buildings is the control of humidity in air supplied for ventilating purposes. One method is to employ an evaporating pan in which a coil of pipe, containing steam at high temperature, is submerged in water. The high steam temperature causes the surrounding water to evaporate and add moisture to the air that is blown over the evaporating pan. An automatic device in the air duct controls the supply of steam to the coil in order that the humidity of the air may be maintained at the desired point.

Another method of adding moisture to air is by means of an air washer which is a large chamber of sheet metal through which the air is passed, with a receptacle for holding water at the bottom. A pump draws water from the bottom of the washer and forces it under pressure through pipes to nozzles which deliver the water in a finely divided spray over the interior of the washer. The air is drawn through the washer and comes in direct contact with the spray which not only cleanses the air but adds moisture to it as well. The amount of moisture absorbed can be varied by varying the temperature of the water by means of a suitable heater, the apparatus also being under automatic control.

In view of the fact that some of the water is vaporized, an amount of heat is abstracted from the air equal in amount to the latent heat of evaporation of the water. The result is that the air is cooled, due to partial evaporation, in passing through the washer. Air washers of this type are, therefore, used to cool the air and they have been used to a considerable extent in certain classes of buildings and manufacturing plants, where air cooling is necessary in hot weather.

It has been found that air cooling is not always satisfactory for the reason that when the air is cooled by means of an air washer, the relative humidity of the air is increased, and air saturated or nearly saturated with moisture is not as pleasant as air at a somewhat higher temperature where the relative humidity is lower. To overcome this objection air cooling plants have been installed where the cooling is carried to such an extent as to lower the temperature of the air considerably below that desired to maintain in a room, and to such an extent to condense part of the moisture that air contains in order that heat may be added to the air after cooling so as to obtain, finally, air at a higher temperature than the temperature of air leaving the washer, but with a lower relative humidity. The net result of this operation is to admit to the room or building air at a lower temperature than the outside air and of a relative humidity that is comfortable. The first cost of apparatus necessary to do this and the cost of operation is considerable, and the expense involved is only justified under special conditions.

Heating by electricity is not done to any great extent, on account of the excessive cost. When coal is burned under a steam-boiler, it is not uncommon for 60 per cent of the heat in the fuel to be realized in the steam which can be used for heating. If the heat in coal be transformed into electrical energy, and this again transformed into heat, less than 10 per cent of the heat in the fuel will be realized for heating.

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Consulting Engineer.

HEATON, Augustus George, American artist: b. Philadelphia, Pa., 28 April 1844. He was the first pupil from the United States to study at the Paris Beaux-Arts, where he was trained by Cabanel. Later (1878–80) he was in the studio of Léon Bonnat, and exhibited considerably at the Salon. Among his paintings are 'Washington at Fort Duquesne'; 'The Recall of Columbus,' engraved on the 50-cent Columbian Exposition stamp of 1893; portraits of Bishop Bowman and Paul Tulane; and 'Hardships of Emigration,' engraved on the 10-cent Omaha Fair stamp. He is the author of 'The Heart of David — the Psalmist King' (1900); 'Fancies and Thoughts in Verse' (1904), etc.

HEATON, SIR **John Henniker,** English postal reformer: b. Rochester, Kent, 1848; d. 8 Sept. 1914. He was for some time prominent in Australian journalism and sat in the House of Commons for Canterbury from 1885 until his death. He carried the Imperial Penny Postage Scheme in 1898; was instrumental in obtaining Anglo-American Penny Postage, which came into force in the same year, as well as telegraph money orders in England, the parcel post between England and France and other postal reforms.

HEATON, John Langdon, American journalist: b. Canton, N. Y., 29 Jan. 1860. He was graduated from Saint Lawrence University in 1880, entered journalism as a member of the Brooklyn *Times* staff in 1881, and in 1897 became assistant editor of the New York *World;* now an editorial writer there. His publications are 'The Story of Vermont' (1889); 'Stories of Napoleon' (1895); 'The Quilting Bee' (1895); 'The Story of a Page' (1913).

HEAVEN, in a physical sense, is the azure vault which spreads above us like a hollow hemisphere and appears to rest on the limits of the horizon. Modern astronomy has taught that this blue vault is in fact the immeasurable space in which earth, sun and planets, with the countless host of fixed stars, revolve. The blue color of the heavens is due to the action of minute particles in the air upon the blue rays in sunlight.

In ancient astronomy, heaven denoted a sphere or circular region of the ethereal heaven. The ancient astronomers assumed as many different heavens as they observed different celestial motions. These they supposed to be all solid, thinking they could not otherwise sustain the bodies fixed in them; and spherical, that being the most proper form for motion. Thus they had seven heavens for the seven planets: the moon, Mercury, Venus, the sun, Mars, Jupiter, and Saturn. The eighth was that of the fixed stars, which was particularly denominated the firmament. Ptolemy adds a ninth heaven, which he calls the *primum mobile.* But others admitted many more heavens, according as their different views and hypotheses required: Eudoxus supposed 23; Regiomontanus 33; and Fracastoro no less than 70.

In theology this word denotes the upper and nobler region of God's universe, in contrast with the earth, the lower part assigned to men for their habitation. Of the belief in the existence of some special scene of the presence of Deity, the majority of the known religions of the world bear ample evidence. According to Aristotle all men, whether Greeks or barbarians, had a conception of God; and all united in placing the residence of the gods in the most elevated regions of the universe. This idea runs through the Persian, Egyptian, German, Scandinavian, and indeed all the ancient religions in which the belief in a supreme being assumes any other form than the pantheistic; and even though the pantheistic philosophers may have denied that any peculiar locality could be regarded as the peculiar habitation of the Deity, we find that popular belief and worship is evidently grounded upon a contrary opinion. In addition, however, to its being the special seat of the Deity, heaven also denotes the place or the state or condition of blessed spirits and of the souls of just men either immediately after physical death or at some certain period subsequent to it. All the religious systems which include the immortality of the soul involve, at least in substance, the idea of a future state of happiness as a reward for a virtuous life. The delights of the heavens of the various beliefs and creeds differ greatly in kind. The pleasures of the classical Elysian fields were to a great extent pleasures of sense; the German warrior believed he would be transferred to a region where he would be able to pursue his old fierce enjoyments; and the American Indian cherished the notion that he quits this world for a happier hunting-ground. Among Christians the general belief is that heaven is the abode of the Most High, the holy angels and the spirits of just men made perfect; that this dwelling-place is eternal, its joys entirely spiritual; it is believed also by many that the just who are free from sin are admitted into heaven immediately after death; also that the souls of the patriarchs, prophets, and in general the good, were detained, before the new dispensation, in a temporary abode till the coming of the Redeemer. See IMMORTALITY; also FUTURE LIFE.

HEAVES, or **BROKEN WIND,** a disease of the horse generally described as unsoundness of the respiratory organs. The disease is not well understood by veterinarians and the treatment is unsatisfactory. It is generally conceded that the disease is incurable. The characteristic symptoms are labored breathing, dilated nostrils, bloodshot eyes and dependent belly. Horses with this disease often drop down while at work and succumb to congestion of the lungs, hæmorrhage or suffocation, the direct result of the heaves. Upon post-mortem examination the stomach is found distended and to have thinner walls than in the normal horse.

HEAVYSEGE, Charles, Canadian poet: b. Huddersfield, England, 1816; d. Montreal, 1879. He was a cabinetmaker by trade, and in 1853 emigrated to Canada, first working at the bench and later joining the staff of the Montreal *Witness*. In 1857 he published ‹Saul,› a drama of great creative power, which has been described as «one of the most remarkable English poems written outside of Great Britain.» His other works were ‹The Revolt of Tartarus›; ‹Jephthah's Daughter›; ‹Count Filippo.›

HEBBEL, hē'bĕl, **Friedrich,** German dramatist: b. Wesselburen (Dithmarschen, Holstein, then belonging to Denmark, now to Prussia), 18 March 1813; d. Vienna, 13 Dec. 1863. His father was a stonemason, his mother a washerwoman, and the conditions of his early youth at home were those of the most frightful poverty. The father particularly was much soured by the family's lot, and had gone so far in his pessimism as to look with disfavor upon even the most innocent pleasures of his two boys, whom he was obliged by bitter necessity to regard as his rivals in the consumption of their scanty meals. Already in his earliest years Friedrich showed a remarkable sensitiveness to impressions of artistic and stylistic character; he tells us, for instance, that such words as *Rippe, Knochen* («rib,» «bone»), by their mere sound aroused his anger, and that he carefully erased them from all his readers and textbooks, while other words, such as *Rose, Lilie, Tulpe,* produced a voluptuous pleasure in him. His father died when the boy was 14 years old, and Sheriff Mohr undertook to bring him up. This man attracted all the repressed hatred and venom of Hebbel's long years of privations, and, by forcing him to consort at table with the lower servants, developed a snobbish tendency in the boy that later occasionally found rather ugly expression. A reading of Uhland's poem, ‹Des Sängers Fluch,› taught him the essence of poetry, and was the beginning of a long correspondence, later friendship, between the two men. A number of Hamburg newspaper readers, having seen some of Hebbel's little poetic contributions to the papers, determined to provide him with the means for university study, but their financial aid was so slight that, during his period of preparation, Hebbel was often starving. At this time, while at Hamburg, begins his friendship for Elise Lensing (1804–54), a poor seamstress, who became so infatuated with him that she devoted to him all her earnings, going even so far as to support his mother without his knowledge. His attitude toward her was that of a grateful recipient, who did not quite understand her affection for him. In 1836 he finally began the study of law at Heidelberg, soon giving up both the study and the city and going to Munich in the autumn of the same year. Here, while attending the lectures of the philosopher Schelling and the mysticist Görres, he soon spent the small sums that Elise Lensing and other persons had given him, and found himself once more in dire want. For two and a half years he never had a warm meal. It is not difficult to understand the illnesses of Hebbel's later years after the privations of his youth and early manhood. At Munich he lived in the family of a poor carpenter, whose daughter, Josefa Schwarz, had considerable influence on him and probably suggested the theme and the treatment of Hebbel's middle-class tragedy ‹Maria Magdalena,› written years later (1843). His first tragedy was written after his return to Hamburg (1839), on a subject found in the apocryphal book of Judith in the Old Testament, and suggested to him by Giulio Romano's painting in the Munich Pinakothek. ‹Judith› (1840) is the story of a woman who sets out to perform a great deed for her country, but actually executes the deed because the victim (Holofernes) has won her love and insulted her womanhood. Holofernes, Nebuchadnezzar's general, is a picturesque tyrant of Asiatic type, impersonating boundless energy, brutality and gloom, and a peculiar tendency to self-torture that is characteristic of many of Hebbel's most powerful masculine characters in other plays. In 1843, through the intercession of the Danish poet Oehlenschläger, Hebbel, on a visit to Copenhagen, obtained from King Christian VIII of Denmark an annual pension of 600 thalers, to run for two years. «Is it not marvelous?» he writes. «Think of Friedrich Hebbel and 1,200 thalers; could you ever have mentioned the two in the same breath?» He visited Paris in 1843 and Rome in 1844. At the former city he was informed that Elise Lensing had lost their little boy, and that she was distracted in consequence. She was eager to marry Hebbel now, for his society at least, but he was determined not to marry her. He did not communicate this decision to her definitely, however, until he had settled down in Vienna (1845 to his death), where he became acquainted with Christine Enghaus (1817–1910), a famous actress at the Hofburgtheatre, whom he married in 1846, after a heartrending correspondence with Elise. «You surely must understand that my life must either have a larger outlook or come to an end.» His letters and his diaries (the latter are of immense importance in any study of Hebbel; they extend from 1835 to his death) are very illuminating in the information they give on this period of his life and the mental struggles it covered. ‹Maria Magdalena› is the story of a girl driven by the worthlessness of a brother, the faithlessness of a lover and the cruel severity of a father to seek her own death. The father's words on hearing of her deed: «The world is a riddle to me,» are a strong arraignment of a generation of parents who impose moral laws upon their children instead of deriving a system of morality from life. ‹Herodes und Mariamne› (in blank verse) is taken, as the name implies, from the tale contained in Flavius Josephus (q.v.), depicting an episode of the transition from ancient paganism and Judaism to later Christianity. ‘Agnes Bernauer’ (1851) is a prose tragedy of Bavarian history, a pathetic tale of the love of a noble prince and a burgher maiden. ‘Gyges und sein Ring’ (1854) is a gloomy and distorted tragedy based on a tale in Plato taken from Lydian history. The Nibelungen Trilogy (finished 1860) has the following sections: ‘Der gehörnte Siegfried,’ ‘Siegfrieds Tod,’ ‘Kriemhilds Rache,’ and deals, like Richard Wagner's famous trilogy, with the old Teutonic legend of Siegfried, but while Wagner's music dramas are based chiefly on the Old Norse version as found in the Eddas, Hebbel's series is taken directly from the Mediæval German Nibelungenlied (q.v.).

Hebbel, like many other German creative artists, was also active as a critical philosopher, his best work in this field being contained in ‘Mein Wort über das Drama’ (1843), and in the diaries. One of the theories dominating his artistic production was embodied in his principle that the best conflicts for dramatic treatment were those symbolizing the great turning points of history, the transition periods between great historic epochs. An examination of his titles alone will indicate that he was powerfully attracted to the development of subjects involving the clash of hostile and incompatible civilizations. He has had an enormous influence over the intellectual life of the cultured middle class in Germany, but, curiously enough, has been practically ignored in other countries. His gloomy, doctrinaire, sententious manner seem to have excluded him, thus far, from the attention of the Anglo-Saxon community. Other works by him are plays: ‘Genoveva’ (1841), ‘Der Rubin’ (1849), ‘Der Diamant’ (1841), ‘Demetrius’ (unfinished, 1863); autobiographical: ‘Meine Kindheit, ein Bruchstück’ (1846); many poems and ballads, including an excellent idyllic epic, ‘Mutter und Kind’ (1857). ‘Werke,’ Säkularausgabe (16 vols., Berlin 1912–13). Biography and criticism: Biographies by Emil Kuh (Leipzig 1907), R. M. Werner (Berlin 1905), Walter Bloch (Berlin 1913), Adolf Bartels, ‘Kinderland, Erinnerungen aus Hebbels Heimat,’ (Leipzig 1914); Scheunert, A., ‘Der Pantragismus as System Hebbels’ (Hamburg 1903); von Scholz, Wilhelm, ‘Hebbel's Dramaturgie’ (Berlin 1906); Schmitt, Salomon, ‘Hebbel's Dramatechnik’ (Dortmund 1907); Horneffer, E., ‘Hebbel und das religiöse Problem der Gegenwart’ (Jena 1907); Kutscher, A., ‘Friedrich Hebbel als Kritiker des Dramas’ (Berlin 1907); Münz, B., ‘Friedrich Hebbel als Denker’ (Wien 1907). In fact, the bibliography is so huge that in 1910 it already filled a large volume: Wütschke, H., ‘Hebbel Bibliographie’ (Vol. VI of the Publications of the Bibliographische Gesellschaft, Berlin 1910). See Maria Magdalena.

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HEBE, hē'bē, according to Greek mythology, the goddess of youth, and the cupbearer on Olympus until replaced by Ganymede. She was the daughter of Zeus and Hera who gave her as a wife to Heracles, in reward of his achievements. At Rome she was worshipped as Juventas. She is described by some authorities as a divinity who had it in her power to make old persons young again. In the arts she is represented with the cup in which she presents the nectar, under the figure of a charming young girl, her dress adorned with roses, and wearing a wreath of flowers. An eagle often stands beside her, which she is caressing.

HEBEL, Johann Peter, German poet: b. Basel, 10 May 1760; d. Schwetzingen, 22 Sept. 1826. He received his education at Basel and studied theology at Erlangen; was made church councillor in 1805; director of the Karlsruhe Gymnasium in 1808, and was raised to the prelacy in 1819. He published a series of poems in the Alemannic dialect — ‘Allemannische Gedichte’ (1803), which attracted a very favorable notice from Goethe, and attained great popularity for their humor, and their fresh and vigorous descriptive passages. Scherr called Hebel's ‘Die Wiese’ the “pearl of German idyllic poetry.” Hebel also wrote excellent stories contained in ‘Schatzkästlein des rheinischen Hausfreundes’ (Tübingen 1811; new ed., Stuttgart 1869; 1888). There are monuments to Hebel in Karlsruhe, Basel and Schwetzingen. Consult Hebel's ‘Sämtliche Werke’ ed. by Keller (5 vols., 1905); his correspondence, edited by O. Behaghel (1883); Längin, G., ‘Johann Peter Hebel, ein Lebensbild’ (Karlsruhe 1874); and Schultheiss, ‘Hebels Leben’ (Heidelberg 1831).

HEBER, hē'bėr, **Reginald,** English Anglican bishop and poet: b. Malpas, Cheshire, 21 April 1783; d. Trichinopoli, India, 3 April 1826. He was educated at Brasenose College, Oxford; distinguished himself by the English prize poem, ‘Palestine’; was elected to a fellowship in All Souls' College; traveled in Germany, Russia and the Crimea; entered holy orders in 1807, and became the incumbent of Hodnet, Shropshire. In 1812 he was appointed prebendary of Saint Asaph, in 1815 Bampton lecturer at Oxford, in 1822 preacher at Lincoln's Inn. From 1822 until his death he was bishop of Calcutta, at that time constituting one very extensive diocese, in all parts of which he traveled to the furtherance of the mission work in progress. He completed the establishment of Bishop's College, Calcutta, begun by Bishop Middleton. Heber is best known for his hymns, which include the familiar ‘From Greenland's Icy Mountains,’ ‘Brightest and Best’ and ‘Holy, Holy, Holy!’ His poetical works were published in 1841. In prose he wrote ‘A Life of Bishop Jeremy Taylor’ (1822), and ‘A Journey Through India’ (1828). Consult the ‘Life’ by Geo. Smith (1895), and Montefiore (1904).

HEBER SPRINGS, Ark., town and county-seat of Cleburne County, on the Missouri and North Arkansas Railroad, 80 miles north of Little Rock. It has extensive agricultural, live stock and lumber interests and contains saw mills, cotton gins, sash and door works, a planing mill, etc., a new courthouse, public and high schools, and two banks with resources amounting to $429,000. The value of its taxable property is estimated at $528,436. The municipal expenditure reaches an average of $4,000 annually. The town enjoys a considerable reputation as a health resort, having nine mineral and sulphur springs. It is visited by many health-seekers, both in summer and winter. Pop. 2,000.

HÉBERT, Jacques René, zhăk rē-nā ā-băr, French journalist and politician: b. Alençon, Orne, 15 Nov. 1755; d. Paris, 24 March 1794. At the beginning of the French Revolution Lemaire published a journal supporting constitutional principles under the title *Père Duchesne.* The Jacobins soon established a rival *Père Duchesne,* of which Hébert became editor. The journal owed its success to the cynical virulence with which it advocated the popular cause and abused the court and the monarchy, and soon had the field to itself. He was a member of the Revolutionary Commune that approved the massacres in the prisons in September 1792, was soon after substitute attorney of the commune, and employed all his influence in forwarding a project to establish the authority of the commune on the ruins of the national representation. The Girondists, who were at that period contending against the Mountain, had credit enough to procure the arrest of Hébert 24 May 1793. Again restored to liberty, he assisted with all his power and influence in the proscription of the Brissotins. Their downfall hastened his own. With Chaumette he established the *Feast of Reason,* and afterward accused Danton of having violated the nature of liberty and the rights of mankind. This terrified both Danton and Robespierre, who suspended their mutual jealousies to accomplish his destruction; and Hébert, with the greater part of his associates, was arrested and guillotined.

HÉBERT, Louis Philippe, Canadian sculptor: b. Sainte Sophie d'Halifax, Quebec, 27 Jan. 1850. He studied for several years in Canada, and later in Paris, where he established his studio. In 1894 he won the Confederation medal awarded by the Canadian government. Among his works are historical subjects executed for public buildings in Quebec, Ottawa and Montreal.

HEBREW ECCLESIASTICAL COSTUME. See Costume, Ecclesiastical.

HEBREW LANGUAGE AND LITERATURE, the tongue in which the ancient Jews spoke and wrote, and the books produced by that people during their settlement in Palestine as an independent nation; these latter constitute the Hebrew Scriptures and are looked upon by the Hebrews as containing the inspired word of God. See Jews and Judaism — Hebrew Language; Jewish Literature; Jewish Philosophical Writers; The Jew in Art, Science and Literature; The Talmud; The Masorah; The Cabala.

HEBREW MUSIC. From the many Bible references to music, the inference necessarily arises that it filled a large part in the life of the ancient Hebrews. It is spoken of not only in the service of religion, where it might naturally have been looked for, but also on the battlefield, at the harvest feasts and in the home. David, prince of singers, employs it to drive away Saul's melancholy. Elisha prophesies under its inspiration. The victory at the Red Sea, the return of Saul and David after the battle with the Philstines, all important national events are celebrated in song. The details of the Temple music, the names, divisions and functions of the singers and instrumental performers are referred to at length. David utilized no less than 4,000 singers in the Temple service, of whom 288 were «skilful»— i.e., virtuosi. Josephus, describing the preparations for the dedication of the Temple, speaks of a band and chorus of 200,000 trumpets, 40,000 string instruments and 200,000 singers; and, even if these figures are liberally discounted, the number must have been imposing.

Yet, in spite of all that modern research has accomplished in reconstructing the vital facts of Jewish history, very little definite information exists on the subject of Hebrew music. This, in itself, is a strong indication that music was but slightly developed by the Jews. Even among the Greeks, most advanced of the ancient peoples in all that concerned the arts, it had practically no independent existence, but was bound up with poetry and dancing and entirely subservient to their demands. The Greeks spent much effort over the scientific aspects of music and its æsthetic considerations and their speculations on the subject are preserved in fairly elaborate form; but there is no trace of any treatise on either the theory or the practise of music among the Hebrews; not even any suggestion bearing on its use is to be found in the widely varied laws of the Pentateuch. The Bible is bare of any real indication of its form, nature or mechanics. All reasonings on the subject are necessarily a priori.

In any discussion of ancient music it must be borne in mind that a different thing is meant than that which the word connotes in its present-day signification. Music, as an art, has the three dimensions of rhythm, melody and harmony; while at the dawn of civilization it was, as one writer has well put it, a «flatland» of two dimensions only, rhythm and melody. So far as scholars have been able to discover, harmony is entirely a modern development. The terminology of the Bible is a stumbling block in the path of students on the subject, who cannot even identify some of the musical instruments named. There are, for example, several Hebrew names which may mean harp, an instrument undoubtedly in use by them, *kinnor, nebel, asor,* all translated in the English version of the Psalms as «psaltery.» The *ugab,* an invention credited to Jubal, is variously called «organ» and «pipe.» The one instrument preserved to the present day is the shophar, a curved trumpet, made of the ram's horn, which is still heard in the synagogue on important holy days. It is the shophar which sounded amid the smoke and thunder of Mount Sinai when the Commandments were given to Moses and to its blast the walls of Jericho fell. While the exact facts are lacking, it is established that the Hebrews had instruments in the three modern categories of stringed, wind and percussion instruments. Save as there may have been interludes between the choral singing and the chanting of the priests, there seems to have been no independent instrumental music; but it almost invariably accompanied the voice and the dance. Hebrew song was probably a unison chant or song-speech, more or less melodious, but entirely subordinate to the text in rhythm and accent. From the form of much of the verse, it seems to have been, at times, antiphonal. Undoubtedly it was crude and noisy and probably without definite pitch, judged by Occidental standards. Even modern Oriental music sounds so to Western ears.

In his method of intoning prayers, the Orthodox Jew of to-day follows the tradition which has been handed down probably from the remote days of the Temple; but this chanting has very little in common with music. It is, in a sense, rhythmical, but the rhythm is that of the words. It has sequence and variations of tone, but they are based on the syntactical structure of the sentences, not the musical exigencies of melody. When, at times, this chanting approaches music in formal semblance, it is an accident due to textual or syntactical impulse. It is always possible, as it is certainly plausible, that the plain song of the early Catholic service, which, in the course of the first thousand years of the Christian era, developed into a rounded and organized body of chants, appropriate to every branch of religious worship, is the direct descendant of the ritual chant of the synagogue. At all events, the latter could not have been without its influence upon the early members of the Christian clergy.

Although there is no music now extant traceable to the Hebrews of Bible days, a body of music of some size and distinct character has grown up during the past few centuries, which, by long association with the ritual and the home-life of the Jews of all countries, has achieved the right to the title of Hebrew music. Differences may be noted between the music of the Sephardic or Spanish-Portuguese Jews and that of the Ashkenazim or Jews of northern Europe, explainable, in part, however, by differences in environment. Probably the oldest of Jewish melodies now in use is the famous Kol Nidre, sung on the eve of the Day of Atonement. It has been popularized through Max Bruch's rather free improvisation. The Chanuka hymn, *Mo'oz Tsur,* the *Oz Yoshir,* sometimes asserted to be Miriam's song of triumph, the *Shir Hama-a-los,* accompanying the grace before meals, the *Addir Hu,* and several other of the Passover songs and the *En Kelohenu,* are known throughout the entire Jewish world. These, and a number of others, with the original texts, were brought together a few years ago in a Hebrew hymnal by Mrs. Solomon Schechter and Lewis M. Isaacs. A real though recent addition to distinctive Jewish music is the Zionist song *Hatikwoh,* which is, however, spiritually and atmospherically old.

No account of Hebrew music would be complete without mention of Solomon Sulzer, the foremost name among Jewish cantors. Born in Austria in 1804, he devoted his marked musical talent to the service of the synagogue. In a whole-hearted endeavor to reconstruct the music of the Jerusalemic days — a task which his enthusiasm refused to admit was impossible — he introduced reforms in the ritualistic chanting, which, while sacrificing little of the traditional atmosphere, vastly improved its musical value. He arranged and composed a large number of responses and settings of psalms and prayers, the best of which are contained in a collection called Shir Zion, which have made for themselves a permanent place in the Jewish world.

Lewis M. Isaacs.

HEBREWS, the distinctive name of that branch of the Semitic family which migrated from Mesopotamia into Palestine, thence went to Egypt, and, after a long period of bondage, reconquered Palestine, and finally settled there. Divided, at a later period into two distinct states, that of Judah and of Israel, they were singly overcome, and led into exile. A portion, chiefly descendants of Judah (Jehudah) returned, and founded a new empire. From that time all the members of the Mosaic commonwealth were known by the name of Jehudins, corrupted into Jews. The word *Hebrew* has come down to us through the Greek 'Εβραίους from the Old Testament word *'ibhri,* used of the people who claimed a common descent from Abraham, whose ancestor was Eber or Heber (Gen. x, 21). 'Ibhri itself is derived from *'abhar,* to cross over, to wander, and may refer to the nomadic mode of life of this people during its early period. For a continuous sketch of the entire history of this people from the days of Abraham to our own, as well as a brief outline of this language, literature, culture, etc., see Jews and Judaism; Palestine; Semites; Semitic Languages and Literatures; Hebrew Music; Zionism.

HEBREWS, one of the canonical books of the New Testament, usually spoken of as «The Epistle to the Hebrews.» The fact that it lacks the introductory formula naming author and recipients, to be expected in every ancient letter, has led some to deny that this writing is a letter. But this form may in this case, as often, have been placed on a separate sheet and become lost, or for some other reason have failed to be copied. At any rate many expressions show that it really was a letter addressed by some individual to a definite group of early Christians. In the King James version it was styled «The Epistle of Paul the Apostle,» and thus has been perpetuated an early Alexandrian tradition, which later became the universal opinion for many centuries. But this view was at first unknown in Rome and the West, where are the earliest traces of the use of this writing, and it differs from the acknowledged epistles of Paul in both style and thought. The language is here more idiomatic and choice; clauses and sentences are connected by an array of conjunctions largely different from those used by Paul; instead of his abrupt, almost disconnected course of expression, earnest to vehemence, we find in Hebrews a series of balanced periods, flowing smoothly even when most emphatic and a style abounding in almost artificial devices of rhetoric. There is no less difference in the theological conceptions and their presentation. While not antagonistic to Paul's doctrines, being rather complementary, the doctrinal teachings here are yet variant, as, for example, the teachings as to the divine Sonship of Christ; the nature of faith, and the value of the law of Moses.

While the Pauline authorship is now set aside as out of the question by the practically unanimous judgment of critics of every school, there is no general agreement as to who did write the book. Clement of Rome and Luke have been urged for no reasons except valueless suggestions made by Clement of Alexandria and his pupil Origen. Harnack has conjectured that it may have been written by Priscilla in association with her husband, Aquila, but this view can satisfy only such as regard it as addressed to Roman Christians. The conjecture of Luther that Apollos was the author has been widely accepted, while the later suggestion that it was written by Barnabas has met with the approval of many scholars of the highest rank. The latter view has in its favor, to be sure, the only ancient testimony of real weight, that of Tertullian, but it must be allowed that either Barnabas or Apollos would meet all the requirements of the case so far as they are now known, and consequently that the authorship cannot be positively decided.

There is no less uncertainty in naming the persons to whom it was originally addressed. The title prefixed very early, though in all probability not originally, was «To Hebrews,» and the view that it was addressed to Jewish Christians is nearly universal. Not a few scholars, however, have lately declared in favor of the view that it was written rather to Gentile Christians. The decision hinges on the answer to the question whether the danger against which the author warns his readers is relapse into heathenism or relapse into Judaism. On the one side it is urged that relapse into Judaism could not properly be designated «apostasy from the living God,» while on the other side it is urged that, while Judaism was in the author's mind good as compared with heathenism, yet its acceptance at cost of a surrender of all that was distinctively Christian might reasonably be styled apostasy. It has certainly seemed to most that the fact that the whole thought of the book is the superiority of Christianity over Judaism proves that the danger against which the first readers were warned was relapse into what the author regarded as relatively worthless because an outgrown and outworn stage of divine revelation, and that the opinion that apostasy into heathenism was the readers' danger is only «an ingenious paradox,» even though «an amount of ingenuity has been expended in support of this hypothesis, sufficient to render it plausible.»

To some extent the questions as to place and date depend for their answer upon the conclusion as to the character of the first readers. If addressed to Hebrew Christians, it is scarcely possible that its date can be later than 68, just before the Jewish War which resulted in the destruction of Jerusalem, and the final removal of the danger of relapse into Judaism, while the fact that it is addressed to a second generation of believers and the references to the lapse of considerable time make it necessary to set the date as late as possible. If addressed to Gentile Christians, it might be dated as late as 85 or even 90. But that in any case it is a 1st-century production is guaranteed by the use made of it by Clement of Rome before the year 100.

Where the first readers are to be looked for hangs as completely on their character as does the question of date. If Gentile, most would think it probable that they were to be found at Rome, where they may have constituted only a single group of many among the Christians in the city. If, however, they were really Hebrews, it is, if not impossible, at any rate less likely that they were at Rome. The reference to «those from Italy» is ambiguous, but it would seem plausible that Timothy had been imprisoned at Rome rather than that on release he should hasten hither. If the core of the book is a warning against Judaism, it would be natural to look for those needing such a warning nearer the Temple than was Rome. While it is generally regarded as improbable that the letter was addressed to the church at Jerusalem, there may have been many communities within easy reach of that city where such a group of Christians as these «Hebrews» could have been found. Syrian Antioch and Jamnia have been named among other places.

The author very fitly styled his work «a message of appeal.» Such it is throughout. To be sure, the first 10 chapters consist largely of argument skilfully marshaled and stated, but all is to strengthen appeal, and exhortation is constantly inwoven with demonstration. The great theme is the superiority of Christianity over Judaism. While this is developed in many phases, it may be briefly summed up in saying that in chapters i–vi the stress is laid on the personal superiority of Christ, as compared with angels, Moses, Aaron, and then (vii, 1–x, 18) the superiority of the work of Christ is set forth. But the whole is one plea for persistence in the Christian profession and life, and while the changes of the centuries have made much in this book peculiarly hard to understand and have robbed other arguments of some of their original force, yet, when understood, this plea for the value of Christianity remains cogent as well as earnest.

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HEBRIDES, hĕb'rĭ-dēz, **The**, or **WESTERN ISLANDS**, Scotland, an archipelago off the west coast, extending from lat. 55° 35′ to 58° 32′ N.; the most southern island being Islay, and the most northern, Lewis. The group is politically divided between the shires of Ross and Cromarty, Inverness and Argyll, very nearly in the line of their coincidence with the coasts of the respective counties. They number about 500 in all, but many are inconsiderable islets and rocks, and only about 100 are inhabited; area, about 2,812 square miles. They are usually divided into the Outer Hebrides, of which the principal are Lewis and Harris (forming a single island), North Uist, Benbecula, South Uist and Barra; and the Inner Hebrides — Skye, Mull, Islay, Jura, Coll, Rum, Tiree, Colonsay, etc. The Outer are separated from the Inner, and from the mainland, by a strait or channel called the Minch, which at its narrowest part, between Harris and Syke, is about 12 miles broad. Ross and Cromarty, Inverness and Argyll are the counties to which they belong.

The climate is mild and salubrious, but variable, tempestuous and humid. Snow and frost are almost unknown in the smaller islands, and are but little felt in the larger. There is comparatively little wood in the Hebrides, and on many of the islands none at all. In Lewis, Skye, Islay, Mull and several of the other islands, however, both forest and fruit trees have been planted to a considerable extent. Oats and barley are almost the only cereal crops raised. Potatoes are extensively cultivated. Cattle constitute the staple product. The native breed are small but handsome. The breed of horses in also small, but hardy and docile. The native breed of sheep is very small, but Cheviots have been introduced with success. The productive land is partly occupied as sheep-farms; much of it is held by «crofters,» who occupy holdings usually of a very few acres, sometimes with a right of pasturage in common attached. There are also «cotters» who occupy houses, with or without a patch of ground, on the land of the crofter, the farmer or the landlord, and who are often mere squatters paying no rent. Grouse-moors and deer ranges cover a considerable area. Owing to the minute division of the arable land there is in many places an excess of population. The condition of the crofters and cotters, especially in the Outer Hebrides and Skye, is very depressed, their dwellings miserable and their living poor, consisting chiefly of potatoes, milk and oats or barley bread, and in bad harvests it is often insufficient in quantity. The fisheries are not developed to the extent they might be. Limestone and slate are the only minerals worked. Whisky is manufactured in Skye, Islay and Mull. Gaelic is still the language of the majority of the inhabitants of the Hebrides. The Hebrides were the Ebudae of Ptolemy and the Hebudes of Pling. In remote times they were subject to the kings of Norway, but in 1264 were annexed to the crown of Scotland. They were held by various native chieftains, in vassalage to the Scottish monarch; but subsequently fell into the hands of one powerful chief, a Macdonald, who in 1346 assumed the title of «Lord of the Isles» and began to exercise a practically independent rule. The abolition of heritable jurisdictions in 1748, which put an end to the system of communal ownership of the soil as well as to the rule of the chieftains, was not an unmixed blessing; and it was followed by exorbitant rentals and by great emigrations to North America. The potato blight of 1846 caused great hardships to the population. The entire relations between owner and tenant in the Hebrides were made the subject of investigation by a royal commission in 1884; this was followed by the Crofters Holdings Act of 1886, under which fair rents and fixity of tenure are assured to the crofters, and the hardships of their lot have been considerably mitigated. The inhabitants mostly belong to the United Free (Presbyterian) Church, but in some of the islands Catholicism is predominant. Little was known about the Hebrides until the publication of 'Johnson's Journey to the Western Islands of Scotland' (1775). In more recent times Scott's 'Lord of the Isles,' and the charming novels of William Black, have invested them with a halo of romance, and the steamers of the Clyde afford ample facilities for tourists who intend visiting the islands. Consult Pennent, 'Tour in Scotland and Voyage to the Hebrides' (1774); Buchanan, 'The Hebrid Isles' (1883); Goodrich-Freer, 'The Outer Isles' (1902); Hartley, 'Wind-Seekers in the Hebrides' (1906).

HEBRON, hē'brŏn (originally Kirjat-harba, now El-Khalíl), Asiatic Turkey, a town of great antiquity in Palestine, 18 miles southwest of Jerusalem, 2,830 feet above sea-level. It lies in the narrow valley of Mamre, has narrow streets, high well-built stone houses with flat roofs, extensive covered bazars, with well-furnished shops, exhibiting glass manufactures, consisting of lamps, colored rings, etc., for which the place has long been celebrated. The chief mosque, El-Haram, built around the Cave of Machpelah, from which Christians were rigorously excluded, is esteemed by Mohammedans one of their holiest places. Hebron is one of the oldest existing towns, having been built seven years before Zoan (Num. xiii, 22), and it is mentioned prior to Damascus (Gen. xiii, 18). It is peculiarly rich in traditional sites. Abraham resided here and acquired the Cave of Machpelah as a sepulchre for Sarah and their descendants. It was taken by Joshua and given as an inheritance to Caleb and made a city or refuge. It was David's royal city for seven years. Here Absalom came to be declared king. The town was captured by Judas Maccabæus from the Edomites, and was stormed by the Romans under Vespasian and burnt down. In 1167 it became a Latin bishopric, and in 1187 it fell into the hands of Saladin. Pop. 22,000 (2,000 Jews).

HEBRON, Neb., city, county-seat of Thayer County, on the Little Blue River, and on the Chicago, R. I. & P. and the Burlington & M. railroads, about 63 miles southwest of Lincoln. It is situated in an excellent agricultural and stock region. It has a large flour-mill, a creamery and a planing-mill. There are five churches, a high school, three banks and three weekly newspapers. The shipments of wheat and live stock are extensive. Electric and sewage plants and waterworks are municipally owned. Pop. 1,778.

HECATÆUS, hek-ą-tē'ŭs, distinguished Greek historian and geographer: fl. about 500 B.C. He was a native of Miletus and the son of Hegesander, a member of an ancient and illustrious family. Of his public life the only event of which we have any definite knowledge was the part he took in the insurrection of the Ionians against the Persians. Being well acquainted with the resources of Persia, he vainly attempted to dissuade Aristagoras, the planner of the revolt, from his undertaking. Later he went as ambassador to Artaphernes and prevailed on the satrap to win the confidence of the Ionians by lenient treatment. His two great works were his 'Tour of the World,' and his 'Genealogies.' The latter is little more than a prose version of the legends already given in versified form. He improved the map of the world made by Anaximander; and his writings were highly esteemed by Herodotus. The fragments of his works were published by Müller (1841–70).

HECATE, hĕk'ā-tē, in Greek mythology a goddess whose parentage is variously given. Homer does not mention her. She appears to have been originally a Titan who ruled in heaven, on the earth and in the sea. She could bestow or withhold at pleasure the blessings of wealth, victory and wisdom to mortals, and was the only Titan who retained power under the rule of Zeus. She was subsequently confounded with several other divinities, was the goddess of night and of the lower world, and at length became a mystic goddess having all the magic powers of nature at her command. She was identified with Demeter and Artemis, and was regarded as the mystic Persephone. Magicians and witches prayed particularly for her aid. Sacrifices used to be offered to her on the last day of the month at places where three ways met (whence her epithet *Τριο δῖτις*, or in Latin, *Trivia*), and these consisted of dogs, honey and black female lambs. Her mysterious festivals were celebrated annually at Ægina. Her appearance was frightful. She had three bodies or three heads, and serpents hung hissing around her neck and shoulders.

HECK, Barbara, one of the founders of American Methodism: b. Ballygarry, County Limerick, Ireland, 1734; d. near Augusta, Ontário, 1804. She was of a colony of German immigrants in Ireland who were among the first to be influenced by Wesley's preaching. In 1760 she came to America with her husband, Paul Heck, and Philip Embury (q.v.). In 1766 she was very active in the organizing of a Methodist society which met at Embury's house, and she also did much toward the building of the Old John Street Methodist Church. Later she and her family removed to the northern part of New York State, and when the Revolution broke out went to Lower Canada (1774), and later settled in Augusta, near Prescott in Upper Canada, and were the founders of Methodism in that province.

HECKER, Friedrich Karl Franz, German-American soldier: b. Eichtersheim, Baden, 28 Sept. 1811; d. Saint Louis, Mo., 24 March 1881. After studying law in Heidelberg, he abandoned his profession for political life. In 1842 he was elected to the Chamber of Deputies of Baden. On the outbreak of the revolution in Germany in 1848 he endeavored to convert the preliminary convention into a permanent republican assembly. Frustrated in this attempt, he put himself at the head of a band of revolutionists, and invaded Baden from the south. He was defeated at Kändern 20 April 1848, and fled to Basel, Switzerland, where he edited a radical newspaper and published his work ‘Die Volkserhebung in Baden.’ He was refused admission to the National Assembly at Frankfort, although twice elected from Thiengen. In 1849 he removed to the United States, and became a farmer near Belleville, Ill. On the outbreak of the Civil War he raised a regiment of Germans, serving in General Frémont's division as colonel; and afterward for a time commanded a brigade. In his later years he watched with great interest the foundation of the German Empire and its phenomenal growth. He published ‘Reden und Vorlesungen’ (1872); ‘Betrachtungen über den Kirchenstreit in Deutschland und die Infallibilität’ (1874).

HECKER, Isaac Thomas, American Roman Catholic clergyman: b. New York, 18 Dec. 1819; d. there, 22 Dec. 1888. In early life he was a member of the Brook Farm community, near Boston, where for nearly a year he officiated as baker for the establishment. In 1845 he became a Roman Catholic; went to Germany to study for the priesthood and joined the Redemptorist Fathers in Belgium in 1847. He was ordained priest in London by Cardinal Wiseman in 1849. Returning to New York he founded the order of the Paulists (1858). nearly all converts from Protestantism, and became their superior; established the *Catholic World* (1865), of which he was editor till his death; and was the founder of the Catholic Publications Society. An anonymous French version of Elliott's ‘Life of Father Hecker’ led to the noted "American" controversy. He wrote ‘Questions of the Soul’ (1855); ‘The Church and the Age’ (1888), etc. Consult Sedgwick, ‘Father Hecker’ (1900).

HECKEWELDER, hĕk'ĕ-wĕl-dėr, **John Gottlieb Ernest,** American Moravian missionary: b. Bedford, England, 12 March 1743; d. Bethlehem, Pa., 21 Jan. 1823. At the age of 12 he came with his father to Pennsylvania. He accompanied Post in 1762 in his expedition to the Indian tribes on the Ohio, and in 1771 took up his residence among them as a missionary. He assisted Putnam in negotiating with the Indians at Vincennes (1792) and Niagara (1793), and also in the negotiations leading to the surrender of the lands granted to the Christian Indians on the Muskingum in 1797. After some 40 years' missionary service, he went to Bethlehem, the principal establishment of the Moravians in America, and there remained till his death. He wrote several memoirs upon the Delaware and Mohegan Indians: ‘Account of the History, etc., of the Indian Nations’ (1818); ‘Narrative of the Mission of the United Brethren’ (1820). Consult the ‘Life,’ by Rondthaler (1847).

HECLA, or **HEKLA,** Iceland, an isolated volcano in the southwest, about 20 miles from the coast. It is of conical shape, terminating in three perpetually snow-clad peaks, the central and loftiest of which, Heklufjall, is 5,110 feet high. The circumference at the base is about 12 miles. It is composed chiefly of columnar basalt and of lava, mostly covered by stones, scoriæ, ashes and other loose volcanic matter. Since the 10th century there are 43 eruptions on record, the most violent occurring in 1157, 1300, 1597, 1636 and 1766. One of the most tremendous occurred in 1783, after which it remained quiescent till 2 Sept. 1845, when it again became active and continued with little intermission for 15 months to discharge itself from three craters, its effects being felt as far as the Orkney Islands, 400 miles distant. The last outbreak was in 1878.

HECO, hay'co, **Joseph,** the first or second naturalized American citizen of Japanese birth, founder of the first newspaper in Japan: b. Kamiya, on the Inland Sea, 1837; d. 1892. In April 1850 with his cousin and nine pilgrims he embarked on a junk, with passenger accommodation for 70 persons, to visit the temple of Kompira in Shikoku. Thence from Marugame they sailed to Miyajima. On a later voyage, in the same year, from Yedo homeward, a storm arose and they were blown out to sea in the Kuro Shiwo. After drifting 50 days, they were picked up by the captain of the American bark *Auckland,* and saw foreigners for the first time. In San Francisco, in 1851, he learned the language and some business. Coming to Baltimore, he received education and friendship from Mr. B. C. Sanders, former collector of the Port of San Francisco. In Washington, he saw President Lincoln and was amazed at republican simplicity. In 1859 he left for Japan and being the only native who could speak English there, was made interpreter for the American consulate at Yokohama, and in 1867 for the United States steamship *Wyoming* in the fight at Shimonoseki, in 1868. He established a newspaper, the first in Japan, and again visited the United States. For many years he gave invaluable assistance in smoothing the intercourse between natives and foreigners and was often in danger of his life from hot-headed and ignorant patriots. His ‘Narrative of a Japanese’ (edited by James Murdoch, 2 vols., 1892) throws strong lights upon the interior history of Japan from 1850 to 1865, while giving pen portraits and impressions of Lincoln, Seward, Sumner, Brooks of *Merrimac* and McDougal of the *Wyoming* fame.

HECTIC FEVER, a type of fever which is intermittent and is distinguished by an afternoon or evening quickening of the pulse, and rise of temperature. The eyes of the patient brighten, his cheeks flush and there is some nervous and cerebral excitement. The fever is succeeded by a profuse perspiration. This affection is frequently associated with phthisis, abscess, or septicæmia, and is of dangerous significance. It is a symptom of chronic suppuration from some cause, in which the wound is not aseptic or well drained. The rise in temperature is attributed to a form of blood-poisoning from the absorption of some parts of the products of putrefaction. Treatment must be directed to the disease from which it arises in each case and of which it may be considered a grave symptom.

HECTOR, Mrs. Annie French («Mrs. Alexander»), Irish novelist: b. Dublin, Ireland, 1825; d. London, 10 July 1902. She began to write at an early age and was a prolific and popular writer. Among her books, all of which enjoyed a wide popularity in the United States, are ‘The Wooing O't’ (1873); ‘Ralph Wilton's Weird’ (1875); ‘Her Dearest Foe’ (1876); ‘The Freres’ (1882); ‘A Golden Autumn’ (1897); ‘A Winning Hazard’ (1897); and ‘Kitty Costello’ (1904).

HECTOR, in Homeric narrative, the son of Priam and Hecuba, and the bravest of the Trojans, whose forces he commanded. His wife was Andromache, the daughter of Aëtion. He encountered the Grecian heroes in battle, and often gained advantages over them. By his presence Troy was invincible; but when he had slain Patroclus, the friend of Achilles, the latter, forgetting his dispute with Agamemnon, resumed his arms to avenge the death of his beloved companion. Pierced by the spear of Achilles, the body of Hector was dragged at the chariot wheels of the conqueror; but afterward, at the command of Zeus, was delivered to Priam for a ransom, who gave it a solemn burial.'

HECUBA, in Greek legend, the second wife of Priam, king of Troy, to whom she bore 19 children including Hector, Paris, Cassandra and Troilus. After the fall of Troy she was given as a slave to Odysseus, and according to one form of the legend, in despair leaped into the Hellespont.

HEDDA GABLER. Ibsen, in ‘A Doll's House’ (1880) and ‘An Enemy of the People’ (1883), had preached the necessity of individualism, but, perceiving that he might be misunderstood as an upholder of self-interest in opposition to the welfare of others, he turned in ‘Rosmersholm’ (1887) and ‘Hedda Gabler’ (1891) to point the danger and futility of sheer self-assertion. Such a notion is implicit in both plays, although ‘Hedda Gabler’ seems chiefly a study of character and least of all a drama of ideas. Hedda is an unscrupulous individualist married to a dull pedant in whose rival for an academic position she finds an earlier lover. This rival is a creative scholar of infirm will who has been reformed by Hedda's school friend, Mrs. Elvsted, and inspired to compose a great work. Hedda is jealous of Mrs. Elvsted, fearful lest Lövborg secure the position for which her husband is contending, and curious to discover how far she can determine the fate of another creature. Accordingly, she exerts her malign influence to spur Lövborg into dissipation, and, when he fancies himself forever disgraced by misconduct and the loss of his precious manuscript, she provides a pistol with which he may end his life. Lövborg dies, but Hedda, who had not foreseen that the pistol would be recognized as hers, is involved in the scandal. She can escape it only by according her favors to a libertine judge, aware of all the facts in the case, and prepared to profit by his knowledge. Although Hedda is without a moral qualm, she cannot endure public shame or submission to the will of another. She therefore shoots herself with the second pistol of the pair that she had inherited from her father.

Hedda is a female Mephistopheles, without passion, instinctively and deliberately evil, yet cowardly. As heartless as Becky Sharp, she is far more corrupt. She loathes her husband with his pedestrian mind and bourgeois interests; she loathes her condition as a wife and a mother soon-to-be; and she loathes Mrs. Elvsted as the good angel of Eilert Lövborg. Her prurient curiosity, her morbid dread of scandal, her malevolent delight in burning the manuscript of Lövborg and insidiously suggesting his suicide, are essential features in this portrait of one of the most disagreeable women of all literature. The play was published in 1890, a year before its first performance in Norway, and was translated into English in 1891 by Edmund Gosse. The authoritative version is that of Gosse and William Archer.

Frank W. Chandler.

HEDDING, Elijah, American Methodist bishop: b. Dutchess County, N. Y., 7 June 1780; d. Poughkeepsie, N. Y., 9 April 1852. At 19 he entered the Methodist ministry, and was appointed successor of Lorenzo Dow. He extended his travels to Canada, and preached the Gospel in various parts. He became a member of the New York annual conference in 1801, and was made a bishop in 1824. He was instrumental in the establishment of the *Zion's Herald* at Boston, the first journal published by the Methodist Church in the United States. Consult the ‹Life› by D. W. Clark (1855).

HEDGE, Frederic Henry, American scholar: b. Cambridge, Mass., 12 Dec. 1805; d. there, 21 Aug. 1890. He studied in Germany 1815–23, was later graduated from Harvard and Harvard divinity school, and after holding Unitarian pastorates in Bangor, Me., Providence, R. I., and Brookline, Mass., was professor of German at Harvard University (1872–81). Deeply read in philosophy, ecclesiastical history, and German literature, he was a finished writer and a much admired orator, and ranked as perhaps the foremost German literary scholar in the United States. Among his writings are ‹Reason in Religion› (1865); ‹The Primeval World of Hebrew Tradition› (1870); ‹Martin Luther and Other Essays› (1888), etc. His ‹Prose Writers of Germany› (1848) is a standard work. He translated poems from the German and wrote numerous hymns for the Unitarian Church.

HEDGE, a fence formed of living trees or shrubs. Hedges are generally composed of one or more of the following plants: Hawthorn, crab, blackthorn, holly, privet, beech, hornbeam, maple, barberry, furze, broom, alder, poplar, willow, yew, box, arbor-vitæ, sweet-briar, etc. When there are so many different species to select from, plants may be found suitable for almost all kinds of soil — such as wet or boggy, and dry or sandy; for all situations, whether sheltered or exposed; and for all purposes, such as fences against cattle, or simply as ornaments for garden and pleasure grounds.

HEDGE-SPARROW, a small brown warbler (*Accentor modularis*), with a sweet plaintive song, very common in Europe about gardens and roadsides in summer. It is not a sparrow at all, but nearly related to the American water-thrushes (*Seiurus*). In Great Britain it goes by many names, as dunnock, etc., and is one of the birds most frequently mentioned in books.

HEDGEHOG, a small insectivorous mammal of the Old World family *Erinaceidæ*, and especially of the genus *Erinaceus*, characterized by its coat of stiff spines. The family inhabit temperate Europe and Asia, but are not known on sea-girt islands. The best known of the score of species is the common hedgehog (*E. europæus*). It has a long nose, the face, sides and rump covered with strong, coarse, yellowish hair, the back with sharp, strong spines; and is about nine inches long plus a very short tail. Hedgehogs, as their name indicates, reside under hedges and in thickets, where they turn over the leaves and root in the mould for insects (especially beetles), snails, lizards, roots, fallen fruit, etc.; they are, indeed, omnivorous. The hedgehog defends itself against attack by rolling itself up, and thus exposing no part of its body that is not furnished with a defense of spines. It may be rendered domestic to a certain degree, and has been employed in Europe to destroy cockroaches, which it pursues with avidity. In the winter, in cold climates, the hedgehog wraps itself in a warm nest, composed of moss, dried hay and leaves, and remains torpid till the return of spring. The female produces four or five young at a birth, which soon become covered with prickles. These animals are sometimes used as food, and are said to be very delicate. The long-eared hedgehog (*E. auritus*) of the East is smaller than the common, and is distinguished by the great size of its ears and shortness of tail. Fossil forms as far back as the Miocene differ little from existing species. No true hedgehogs exist in America; the animals often so called being the very different porcupines (q.v.).

HEDIN, Sven Anders, svĭn ăn'dĕrz hĭ-dēn', Swedish geographer and explorer: b. Stockholm, 19 Feb. 1865; was educated at Stockholm, Upsala, Berlin and Halle, at the latter university receiving the degree of doctor of philosophy. In 1885 he began his first journey of exploration through Persia and Mesopotamia. In 1890 he went to Persia as a member of King Oscar's embassy to the Shah, and the next year journeyed through Khorassan and Turkestan. In 1893 he set out on a remarkable journey from the Russian frontier to Peking, through Tibet and the Lob-nor region. He arrived at his destination in 1897, having experienced four years of exciting and harrowing adventures. His second expedition to Central Asia began in 1899. In 1901, writing from Narkhlik, Dr. Hedin tells of finding the ruins of a beautiful Buddhist temple, some rare specimens of wood carving and 12 complete letters written in Chinese on paper and marvelously well preserved. He started from Chinese Turkestan in 1906 for the third journey of exploration in Tibet. During two years he covered some 4,000 miles, discovered the sources of the Brahmaputra and the Indus, several mountain ranges and Lake Chunitso. Early in the European War Dr. Hedin visited the German front, where he was granted special facilities for observation. The result was a book entitled ‹A People in Arms› (Leipzig 1915), in which the author poured out a torrent of vitriolic abuse over Great Britain and of fulsome adulation for everything German. The book caused considerable amusement among the Allies, particularly the reference to the German Crown Prince, «tall, slim and royally straight, dressed in a dazzling white tunic and wearing the Iron Cross of the first and second class. . . . Would you like to know what the German Crown Prince eats for supper? Here is the menu. . . .» Dr. Hedin has made numerous valuable contributions to geographical literature. His works include ‹A Journey through Persia and Mesopotamia› (1887); ‹King Oscar's Embassy to the Shah of Persia› (1891); ‹A Journey through Khorassan and Turkestan› (1892); ‹Through Asia› (2 vols., 1898); ‹Central Asia and Tibet› (1903); ‹Adventures in Tibet› (1904); a scientific treatise in German, ‹The Results to Geographic Science of my Travels in Central Asia› (1900), and ‹The Scientific Results of a Journey in Central Asia 1893–1902 (6 vols., 1904 *et seq.*).

HEDONISM is the name applied to any system of ethics which regards pleasure or happiness as the chief good; as the good, that is, which makes all other goods desirable and to which they are all means. Not only money, health and the like are valuable merely as sources of happiness, but virtue itself has no better claim to independent worth. In fact, for most hedonists, virtue is the name given to that kind of action which long experience has shown to conduce to happiness. The most important of the many subdivisions of the theory is that which distinguishes psychological from ethical hedonism. According to the first, pleasure is the inevitable content of every choice. Even in those instances of self-sacrifice which seem the most radical contradiction of such a view, the exception is apparent rather than real. For the martyr, death is preferable to denial. If it were not pleasant to him, he would not and could not choose it. Ethical hedonism, on the other hand, makes the choice of pleasure a duty rather than a fact. The two have sometimes been regarded as incompatible, on the ground that what necessarily regulates choice cannot be exalted into an ideal; but the frequent inclusion of both in the same system may have a partial justification in the necessity for the rejection of certain pleasures and the acceptance of certain pains, if the greatest possible happiness is to be attained in the end.

A second division of the forms of hedonism is that between individual and universal, and is based upon the number of persons whose happiness constitutes the good. Individualistic hedonism regards the happiness of the man concerned as his own chief good, while that of other people is either a matter of indifference to him, or else is of importance merely because it forms one of the elements of his own happiness. Evidently psychological hedonism is necessarily individualistic, although its combinations with ethical hedonism have often made it present an appearance of universality not strictly compatible with its original assumptions. Although there are plenty of modern instances of individual hedonism, these do not differ in essentials from the classical forms presented by the Cyrenaicism of Aristippus (cr. 435–356 B.C.) and the Epicureanism that sprang from it (Epicurus 342 or 341–270 B.C.). Both Aristippus and Epicurus taught that individual enjoyment was the supreme good, but they differed in their conception of the nature of enjoyment and of the means by which it was to be obtained. Aristippus advocated seizing the pleasure of the moment, untroubled by regret for the past or dread of the future. Epicurus, while he also preached against fear and regret, maintained that the object of desire was a happy life rather than a succession of pleasant moments, an organized whole, not a mere sum. Another distinction between the conception of the two is found in the nature of the pleasurable state as described by each. For Aristippus its chief characteristic was excitement; for Epicurus, tranquillity; a difference that undoubtedly was largely responsible for the different means advocated by them. The later modifications of both theories show the well-known tendency of hedonism toward pessimism.

Universal hedonism was first brought markedly into notice by the Utilitarians, who found the supreme good, not in each man's own happiness, but in happiness in general, usually expressed by the formula «the greatest good of the greatest number.» The moral worth of an action must be judged by the amount of happiness it will tend to bring about in the long run; and the consideration of all the different elements of intensity, length of time, certainty, possible complicating pain, and so forth, known as the hedonistic calculus, is associated with the name of Jeremy Bentham (1748–1832). John Stuart Mill (1806–73), to whose clear and persuasive mode of statement the theory owes much of its popularity, added to it the distinction between quality and quantity in pleasure. With the exception of Mill, both ancient and modern hedonists have almost invariably regarded pleasures as differing from one another in quantity alone; he, on the contrary, maintained that their differences were primarily qualitative, and that quality must be considered in the conception of the chief good. An action is to be judged, not only from the amount, but from the kind of happiness it causes. Mill's view has met with much adverse criticism, based upon the contention that with qualitative differences in pleasure a non-hedonistic criterion has been introduced, which is inconsistent with the initial assumption of hedonism. The adoption of hedonism by the evolutionists, especially by Spencer, has given it a scientific basis, to which its present currency is partly due. Although the end in such systems is preservation, either of the individual or of the species, or of both, yet the actions best adapted to that end are accompanied by pleasure, and the animal to whom useful actions are painful, does not perform them and is in course of time eliminated. Actions found desirable in the history of the race come to have a feeling of obligation attached to them; and although at present end and means may to the individual consciousness seem incompatible, yet as man becomes better adapted to his environment, all virtuous, that is, useful, actions will bring pleasure directly as well as indirectly.

As a theory of ultimate value hedonism can, of course, be neither proved nor disproved. Its chief advantages are: (1) It provides a simple and self-consistent account of moral action. (2) It makes possible a closer union between ethics and natural science than that allowed by any other theory, and is able to make use of the constantly growing store of knowledge in biology, anthropology and ethnology. The most important objections brought against it are: (1) It confuses origin with value. (2) In regarding the moral end as constituted by feeling alone, it is psychologically inadequate, and psychologically false in so far as it views pleasure as the exclusive object of choice. See also ETHICS; UTILITARIANISM.

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HEEL-FLY. See BOT-FLY.

HEER, hār, **Oswald,** Swiss naturalist: b. Nieder-Utzwyl, Switzerland, 31 Aug. 1809; d. Lausanne, 27 Sept. 1883. He was educated at the University of Halle; entered the ministry in 1831; was privat docent in botany in the University of Zurich 1834–52, and from 1852 professor of botany at the University and at the

Polytechnicum, and from 1835–83 director of the botanical gardens at Zurich. His most important works were 'Flora Tertiaria Helvetiæ' (1854–56); 'Tertiary Climates in Their Relation to Vegetation' (1860); 'Die Urwelt der Schweiz' (1865); 'Flora Fossilis Helvetiæ' (1877); and 'Flora Fossilis Arctica' (1865–83).

HEEREN, hā'ren, **Arnold Hermann Ludwig,** German historian and philologist: b. Arbergen, near Bremen, 25 Oct. 1760; d. Göttingen, 6 March 1842. He was educated at the cathedral school of Bremen and the University of Göttingen; in 1794 was appointed professor of philosophy and in 1801 professor of history at Göttingen. His chief works are 'Ideen über Politik, den Verkehr und den Handel der vornehmsten Völker der alten Welt' (1793–96, 4th ed. 1824–26); 'Geschichte des Studiums der klassischen Litteratur seit dem Wiederaufleben der Wissenschaften' (1797–1802); 'Geschichte der Staaten des Alterthums' (1799); 'Geschichte des europäischen Staaten-systems und seiner Colonien' (5th ed. 1830); 'Versuch einer Entwickelung der Folgen der Kreuzzüge' (1808) and 'Vermischte historische Schriften' (1803–88).

HEERMANS, Forbes, American dramatist: b. Syracuse, N. Y., 25 Oct. 1856. He was graduated from Cornell University in 1878, and is author of the dramas 'Love by Induction' (1889); 'The Silent Witness' (1890); 'Between Two Foes' (1899); 'The Vagabond' (1893); 'Jess of the Bar Z Ranch' (1896); 'Down the Santa Fé Trail'; and the novels 'Thirteen Stories of the Far West' (1887); 'The Rancho of Heavenly Rest' (1892); 'The Investigators'; 'Beacon Island' (1907); and 'Buena Ventura' (1911).

HEGEL, hā'gĕl, **Georg Wilhelm Friedrich,** German philosopher: b. Stuttgart, 27 Aug. 1770; d. Berlin, 14 Nov. 1831. He attended the gymnasium of his native city, and in 1788 was matriculated at the University of Tübingen, where he studied theology, finishing his course of study in 1793. From 1793 to 1796 he was private tutor in Switzerland, devoting his leisure, meanwhile, to theological and historical studies. In 1797 he accepted a private tutorship in Frankfort and remained there until 1800. During this period he wrote out the earliest sketch of his philosophical system, and, resolving to devote himself to philosophy, went, in November 1800, to the University of Jena, as privat docent. Here he lectured on philosophy until the troubles which followed the battle of Jena in October, 1806, interrupted for a time his scholarly work. During the years between 1800 and 1806 Hegel's philosophical teachings had assumed a much more highly organized form; he had published a number of important essays; and at the moment of the battle of Jena was just completing his first great systematic treatise, the 'Phänomenologie des Geistes,' i.e., the 'Phenomenology of Mind.' Unable to obtain, for the time, satisfactory opportunity as an academic teacher, Hegel thereafter passed a year as editor of a journal in Bamberg; and then obtained a position as rector of a gymnasium in Nürnberg, in 1808. He married the daughter of a distinguished Nürnberg family in 1811. Thereafter, while still at Nürnberg, he wrote his most important and finished philosophical treatise, the 'Logik,' in the years 1812–16. In 1816 he was appointed to a professorship of philosophy at the University of Heidelberg. In 1818 he accepted a call to the University of Berlin, where he rapidly won a position of the greatest influence, gathered about him many hearers and disciples, and became the head of a school of philosophy whose influence upon contemporary German thought was of the greatest. During his life he published, in addition to the works already mentioned, a summary statement of his whole system of philosophy entitled 'Encyclopädie der Philosophischen Wissenschaften,' and a treatise on the 'Philosophy of Law.' His lectures on the 'Philosophy of Religion,' on the 'History of Philosophy,' on 'Æsthetics,' and on the 'Philosophy of History,' were published posthumously. His complete works, including his letters, fill 19 volumes, which were edited by a group of his friends, in the years immediately following his death (excepting only the letters, which in their definitive edition, were published as Volume XIX of the works by his son, the historian, Karl Hegel, in 1887).

Hegel's philosophical position can only be understood in the light of his relation to Kant. Immanuel Kant (q.v.) (1724–1804) became, by the publication of his 'Critique of Pure Reason,' in 1781, the leader in the movement of modern German philosophical thought. In an age when the guidance of "Reason" was especially glorified by all the leading liberal and progressive teachers and parties of the day, Kant undertook a systematic inquiry into the nature, the limits and the scope of the human reason. Previous philosophers, in the 17th and 18th centuries, had been especially divided in opinion regarding the question whether experience or reason is the source of our knowledge. Kant undertook to reconcile the conflicting views regarding this problem and at the same time to map out, in a systematic way, the whole field which is accessible to human science. His result was, in substance, as follows: Human knowledge depends upon two factors, experience and our own intelligence. Both factors are equally necessary for knowledge. Experience, when viewed apart from our intelligence, is a collection of mere data of sense, which are given, but which, in so far as they are *merely* given, are meaningless. The data of sense get their coherence solely through the active work of our intelligence. Our intelligence, whose manner of acting is spontaneous, is indeed awakened to reaction only through sense; and can give us knowledge only with reference to the facts of experience; but the data of sense get all their form, coherence, structure, meaning, only through the fact that our intelligence is guided in its activity by certain "categories," and formative principles, in terms of which we interpret these data, view them as due to coherent "objects of experience," and connect these objects so that the latter form the "world of experience." Without the intelligence, then, with its "forms," no coherent experience is possible. Sense shows us, by itself alone, no objects, no connections of objects, no laws, no facts, no world. That we appear to find, in our world of perception, connected things, subject to laws, is due to the more or less hidden work of our intelligence, which gives form to the otherwise incoherent sensations. That we all have the same phenomenal world to deal with is due to the fact that intelligence is common to us all, in the same forms.

In consequence, what we know, and what our sciences of experience study, is neither a world of things simply given to us as brute facts from without, nor yet a world of mere sensations. On the contrary, what we know is the world of experience as our active intelligence inevitably *interprets* experience. Hence we know, not "things in themselves," but "phenomena," and not mere "data" of experience, but experiences as interpreted by the active constructive work of our intelligence.

Meanwhile, our intelligence, upon its higher levels, is indeed not content with this mere interpretation of the contents of sense; but — still in its own spontaneous way — defines ideals of objects and of laws which far transcend — according to our own conception — the facts of experience. The "Reason" proper, as distinct from the "Understanding" (that is, from the intelligence which merely interprets and renders coherent our experience), is the part or aspect of our intelligence which is concerned with these other and "transcendent" objects. The objects of the "Reason" proper, are objects which no human experience can reach or exemplify, and which we therefore conceive as lying beyond any possible experience. Such objects are God, the human ego itself, in its true nature, the cosmos in its entirety and the moral law. Such objects we cannot, in any scientific sense, "know," just because our knowledge is limited to our interpretation of experience — an interpretation due to the functions and to the categories of our lower intelligence, i.e., of our "understanding." Yet if the "transcendent" objects of the "pure Reason" cannot be "known," they nevertheless can be and must be "postulated," by virtue of a certain active and spontaneous "faith" which the Reason warrants. For these "transcendent" objects have for us a moral value and give a meaning to life.

We "know," then, "phenomena." Our "Reason," meanwhile, gives us "faith" in certain "Ideas" which relate to the "transcendent" objects. This faith is not knowledge, but is rationally warranted. It is the office of philosophy to bring to consciousness the "categories" in terms of which we inevitably interpret phenomena, and so organize our experience and get our science. It is also the office of philosophy to discover and define the "Ideas" in terms of which we just as inevitably organize our moral conduct and give meaning to our practical life.

So, for Kant, this view of philosophy differs from the view of older philosophy in limiting our inquiries to the business of *interpreting experience* and *organizing life*. The philosopher then, is above all concerned with the universe, as the human Self, that is, as the Self which is, in type, the same in all of us, sees the universe, acknowledges it, and gives to it, in the form in which we experience its presence, the type of rational coherence. Any world which is not the world as the Self views it, is unknowable, and is a world of "things in themselves."

Hegel, in common with the other post-Kantian German idealists, builds upon the basis of this Kantian analysis of knowledge and of reason. His dependence upon Kant is shown by the very fact of his frequent and persistent criticism of that philosopher's positions. That Hegel's results are in one sense far removed from those of Kant becomes obvious upon a very brief consideration. But that, however much Kant's doctrine is transformed in Hegel's system, it is still Kant whose views are the principal ones thus transformed, is also certain. The relation can be made more explicit by the following statement of the contrast between Kant and Hegel:

1. The result of Kant's philosophy is that the accessible world is the world as the rational nature of the human Self requires us to interpret it. This result lies at the basis of Hegel's doctrine. But Hegel transforms it by dropping out of consideration, the adjective "accessible," as being superfluous. It is useless to talk of a world of unknowable or inaccessible "things in themselves," as Kant does. The world of reason is simply the world. There is nothing to know except what the nature of our intelligence requires us to acknowledge. Discover the secret of reason and you have discovered the secret of the universe. This is the first characteristic thesis of Hegel's idealism. "Behind the curtain which is said to hide the inner nature of things," says Hegel in the 'Phenomenology,' "there is nothing, unless we ourselves go behind that curtain."

2. Kant furthermore divides the work of our intelligence between the activity of the "Understanding," which interprets special experiences, and the "Ideas" of that "Reason," which "postulates" our relations to ultimate reality. Hegel accepts this distinction as valid within its limits, but not as any absolute distinction. Our intelligence may and often does fix its attention upon fragments of knowledge. In that case it "abstracts" from the whole meaning of its own life, and thereby becomes *ipso facto* an "abstract thinking" or "understanding" of this or that object or law. Such abstractions are useful and inevitable. But they are not final. The truth, however, is in Hegel's phrase, simply "the whole." Only that form of reason therefore which is concerned with the *whole* meaning of life is genuinely philosophical. But since this meaning is, after all, our own meaning, the meaning of the Self, it need not be simply a matter of "Postulates." It can be known to us.

3. Kant limited our knowledge to "phenomena." But this "limitation" loses its significance if once we see that there are no "things in themselves" to know. The world is for us a world of mere "phenomena" only in so far as we do not grasp the principle of which our experience is the expression. But, for Hegel, this principle is simply the absolute principle which lies at the basis of our own nature. As this absolute principle is not foreign to the Self the Self can grasp the principle. When it does so, it sees phenomena as the inevitable expression of the meaning of its own life. And then its phenomena become once more "actualities," as real as any finite facts could be. What we know then is not a *mere* world of phenomena. It is a world of absolute Truth.

4. Our ethical ideals form, for Kant, a world of their own, which we can never *know* to be real, but which we can, and must, *believe*

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to be real. This contrast of ideal and real, of knowledge and faith, Hegel believes to be founded only in a historical difference of certain stages of our own self-development. Faith, if once brought to a clear self-consciousness, becomes a knowledge as to what the absolute Self is and determines. And this knowledge philosophy can attain. Such a knowledge is *ipso facto* a knowledge of truth. For all truth is in and of the true Self, i.e. the Absolute.

5. Kant, in trying to define the categories which lie at the basis of our interpretation of the world, had simply accepted those categories which he observed to be in use in our daily thinking, and in science. He treated them as a fixed set of principles. Regarding the origin and the mutual relations of these categories he has no extended theory. The categories are, for him, ultimate facts of our intelligence, determining its constitution, but of unknown source. Hegel, on the contrary, regards it as one of the principal tasks of philosophy to show why and how we come by just these categories which we use in the interpretation of experience, and in the ordering of life. His principal work, the 'Logic,' is devoted to such a treatment of the categories. And in fact, since, from Hegel's point of view, the world of "Thought" is the only real world, or, in other words, since the constructions of that absolute process which embodies itself in our thought and in our life are constitutive of *all* truth, this Logic, which is to show the true genesis and nature of the Categories, takes the place of all that, in the older philosophical systems, had been called Metaphysics. For the theory of the absolute constructive process which expresses itself in our experience and in our thinking is simply the theory of the universe. There is no other world to know than this world which thought constructs, which experience observes, and which constitutes our life and its meaning.

6. For Kant, nothing absolute is knowable. All our knowledge is relative. For Hegel, absolute knowledge is possible; for whoever knows the principles that determine the true nature of our thought and of our life, finds these principles, as the expression of the true Self, absolute.

This contrast of the positions of Kant and of Hegel may help to give the Hegelian philosophy its proper historical setting, without which it inevitably appears to be a presumptuous attempt to transcend the natural limits of human reason. For Hegel, these limits are not what they seem. That is, they are not absolute limits. For what we have to consider, when we philosophize, is not a foreign world, but is rather the whole truth with regard to the meaning of the very life which we ourselves are experiencing and are living.

In his first great work, the 'Phänomenologie,' Hegel gave an account of the various successive stages through which the human mind, as it appears in history, passes, in its transition from a naive dependence upon the senses to the stage of philosophical reflection. In his 'Logik,' as has just been stated, Hegel undertakes to describe the way in which philosophical reflection leads us to the categories. The categories themselves are successive stages or phases of our interpretation of absolute truth. Their succession itself is determined by a certain "dialectical" procedure, whereby the lower categories are, through an imminent development, transformed into the higher categories. In the system of Hegel, as he planned the order of its parts, the 'Logik' is next followed by the 'Naturphilosophie,' or 'Philosophy of Nature.' The only connected treatment which this portion of the system ever received is the mere compend contained in the second part of Hegel's 'Encyclopädie.' The 'Naturphilosophie' consequently remained, from Hegel's point of view, imperfectly worked out. The third portion of the system was the 'Philosophy of Mind.' This also was left without adequate working out by the philosopher, although in his 'Rechtsphilosophie,' in the third section of his 'Encyclopädie,' and in his posthumously published lectures, there is a very extended treatment of various parts of this concluding portion of his undertaking. Under the 'Philosophy of Mind' Hegel included, first the whole range of psychology, and the philosophical theory of the relations between nature and mind; secondly, ethics and the philosophical theory of the state; thirdly, philosophical æsthetics, or the theory of the beautiful; and finally the philosophy of religion.

The range and general intention of the Hegelian doctrine are thus suggested although, owing to the vast range of his undertaking, this can here be done only in a very inadequate way. Further characteristics of the philosopher are especially (1) his "dialectical method," and (2) his theory of the Absolute.

By the dialectical method Hegel means a procedure of which some of the dialogues of Plato give us classical instances, and which Kant's "Antinomies" as well as Fichte's method of procedure in philosophy had exemplified, although the systematic use of the method in Hegel's way is due to his own initiative. Truth, according to Hegel, comes to us, in the first place, through the medium of "immediate" experience. Without such experience, we could indeed proceed no further on the way toward insight; and this is the permanent justification for "empiricism" in philosophy, if only we observe that this barely immediate experience, although indispensable, remains meaningless unless we transform experience through the activity of our thought. Thought begins by observing that immediate experience, taken merely as it comes, is, so far, not yet intelligible. The first work of our thought is therefore to classify, to divide, to fix upon distinct aspects of facts, to form generalizations and so to convert what comes to us as immediate into the abstract form of our various *Gedanken*, or conceptual constructions. This is, so far, the work of "the Understanding." Such work first results in our regarding truth as something which, on the one hand, is fixed, *universal*, and abstract, while, on the other hand, this world of truth also appears to us to be a world of infinitely *various* special truths, which relate now to this and now to that individual thing, or fact, or law. So far as our understanding dwells upon the fixity, the universality, the abstract generality of its truths, it finds, or endlessly seeks to find *unity* in the world. But so far as the understanding, even in this very effort to discover unity, singles out now this and now that fact or law, it is confronted by the *variety* of the results which it reaches. There results the well-known problem of "the

One and the Many.» In consequence, the understanding is involved in contradictions which are simply inevitable. In the world of the understanding, «everything is self-contradictory,» and is so just *because* the understanding makes formal consistency the one test of truth, even at the very moment when it expresses its search for truth in the form of an effort (1) to divide what is inseparable, and (2) to substitute abstractions for life.

The forms which the resulting contradictions assume are well known in the history of philosophy. The interest in abstract unity is shown in extreme form in the Eleatic reduction of the whole world to a simple One Being, by contrast with which all variety is illusory. The Atomistic thesis, which reduces all the qualitative variety of nature to quantitative differences, the material substance of Descartes, whose only attribute is extension, the sole substance of Spinoza,— these are also consequences of the tendency to understand variety by reducing it to an abstract and lifeless unity. On the other hand an equally abstract pluralism, in all the earlier stages of philosophical thought, has emphasized variety, with the result of making it inconceivable how the facts, when regarded as thus mutually isolated, could conspire to make a world at all. Views of one type have, by their very contradictions, led over to views of the opposed type.

The solution of all such difficulties lies in reducing the contradictions to their «ground,» which lies in the very «movement» of thought itself. For the truth of such views lies in their synthesis, not in their mere conflict. Such a synthesis is furnished by the discovery that the search for unity and the interest in diversity and variety are but «aspects» or «moments» of that life of self-comprehension in which the very nature of reason consists. When thought, by virtue of a deeper reflection upon the contradictions of the understanding, has reached this higher stage of the reason proper, it therefore views the successive opposing views as inevitably one-sided expressions of different aspects of our rational interest. Our world is indeed one; and in order to bring this fact to our consciousness, we have, upon the stage of the understanding, to emphasize this very aspect of Being and of the life of our own thought to such an extent as to isolate, by our abstraction, the unity upon which we then dwell, from the very variety of which it is the unity. Now unless we pass through the stage of doing this we should never bring the unity of things to light at all, but should leave this aspect of the «immediate» lost in the original obscurity in which, apart from thought, all experience is involved. But so long as we remain upon this stage of abstract reflection, we nevertheless inevitably contradict both experience and ourselves. For experience is of the many, as well as of the unity. And an abstract unity, which is the unity of nothing, is indeed a self-contradiction.

But while our world is indeed also many, and while, in order to bring this aspect of things to light, we must emphasize pluralism, yet the resulting views, taken in their abstraction, are as contradictory as are those of mere monism. The many could never co-operate in one world were they not also one.

Thus we cannot reach truth without passing through contradictions. For the truth is a synthesis of various points of view. No one of these can be appreciated unless it has first been emphasized. If once emphasized it becomes, however, in its isolation, self-contradictory, just because it has its truth not in its isolation, but in its relations to the other points of view. But in order to be able to see that these very relations are necessary, and are not merely adventitious and empirical, we must see *how* the isolated point of view contradicts itself. The sequence of these isolations of special categories (followed by the resulting contradictions, and by the necessary synthesis), constitutes the «dialectic movement of thought,» by which the «immediate» experience, with which we begin, is transformed into the system of truth, wherein all the elements appear in necessary interrelations to one another. The principle of this method is what Hegel calls the «Negativity» of thought. *The denial, or sublation of imperfect stages of insight is the only means whereby the perfect stage can be made explicit.* This is the principle of the dialectical method.

The Hegelian theory of the Absolute is the correlate of this theory of the process whereby truth is acquired. For the dialectical method is not only a method of acquiring insight; but, since thought is, in principle, identical with the very life of the universe, the method by which we come to insight is also the very method by which the life of the world is developed. Man is simply the world come to self-consciousness, — the Spirit explicitly aware of its own life. This is the obverse aspect of the thesis that the true Self is the world. Viewed objectively, the Hegelian doctrine accordingly is that the world-ground, or «the Spirit,» also called the Absolute, has a life, or activity, whose forms are expressed in the categories of the 'Logic.' This life has first to manifest itself in experience as a world of immediate facts. This immediately given outer world constitutes what we call Nature. Such a world has to exist, and to be found by us, in order that the forms of thought should be, not *mere* forms, but forms expressed in a concrete and immediate way. In life, and especially in rational beings, the thought which is everywhere present in nature reaches a still higher expression, which at last becomes identical with our own insight, as this insight developes through the historical evolution of humanity. The entire world-process is therefore the complete expression of a rational spirit, which indeed eternally possesses self-consciousness, but which, when viewed historically, appears to us as attaining such self-consciousness, in individual form, in the religious and in the philosophical consciousness of man.

This must suffice as an outline of Hegel's main thoughts. Owing to the interest which he had in viewing the entire course of human history as a series of movements determined by the dialectical processes of which all our life, according to him, consists, Hegel took great interest in the philosophy of history. The influence of his school has been, in consequence, of great importance in affecting the spirit of a great number of modern historical inquiries. The highly ambiguous relations of the Hegelian system to traditional theology proved very momentous for the development of the critical study of religious dogma, and of religious history, during the generation after his death. While the original Hegelian school ultimately lost its direct influence in Germany, the indirect influence of the Hegelian system still remains very great, and is especially noticeable in English and American thought since 1865.

Bibliography.— Stirling, 'Secret of Hegel'; Edward Caird, 'Hegel' in Blackwood's 'Philosophical Classics' (1883); Kuno Fischer, 'History of Modern Philosophy,' (Vol. VIII, trans. into Eng. by T. P. Gordy 1887); Rosenkranz, K., 'Georg Wilhelm Friedrich Hegel's Leben' (Berlin 1844); Haym, R., 'Hegel und seine Zeit' (ib. 1857); McTaggart, 'A Commentary on Hegel's Logic' (Cambridge 1901); and for brief summaries, the various histories of philosophy by Windelband, Thilly, Höffding and Weber.

JOSIAH ROYCE,
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HEGELER, Wilhelm, popular contemporary German novelist: b. Varel, Oldenburg, 25 Feb. 1870. He studied law at the universities of Munich, Geneva and Berlin, traveled extensively, and returned to Munich in 1895 to settle down to literary work. He moved to Berlin in 1897, to Weimar in 1906, where he has lived ever since, engaged in the production, at first, of naturalistic novels dealing with the life of the population along the river Rhine, later, of humorous satires. His stories were at first characterized by a rather sharp and painful naturalism, but later assumed a convincing and powerful realism. Their popularity in Germany is very great, and Hegeler's books have frequently appeared among the lists of best sellers for certain years (1905, for instance). His more important works include 'Sonnige Tage' (novel, Berlin 1898); 'Ingenieur Horstmann' (his best novel, Berlin 1900); 'Das Ærgernis' (his best satirical novel, Berlin 1907).

HEGIRA, hĕj'ĭ-ra, **HEJRA,** or **HIJRA,** an Arabic word meaning «going away,» commonly used to indicate Mohammed's flight from Mecca, in 622 A.D. In 639 Caliph Omar instituted a new Moslem calendar, to begin with the first day of the first month of the year in which the flight took place. The Mohammedan year, as a lunar year, is shorter than ours by ten days, 21 hours and 14⅖ seconds. A rough and ready method for finding the year in our calendar corresponding to a given year in the Mohammedan is to subtract from the latter 1/33 of itself and add 622 to the remainder. To find the precise year and day multiply the year of the Hegira by 970,224, strike off from the product six decimal figures and add 621.5774; this will give the year of the Christian era; and the day of the year is got by multiplying the decimal figures by 365.

HEIDELBERG, hī'dĕl'bĕrg, Germany, an old university town in Baden, on the left bank of the Neckar, here spanned by two bridges, 11 miles by rail east-southeast of Mannheim. It stands on a narrow strip between the river and the rock on which the castle is built, and chiefly consists of the Hauptstrasse, the long main street, and less important steeply-sloping cross and parallel street. The neighborhood abounds in ancient remains and is rich in historic and literary associations. The city has an electric street railway system. The imposing castle, on a height above the town, an immense ivy-clad ruin begun in the 13th century, exhibits elaborate examples of early and late renaissance architecture. It is often called the «German Alhambra,» and was enlarged at different periods from the 13th to the 18th centuries. It was almost destroyed during the wars with Louis XIV in the 17th century and in 1764 was reduced to its present condition by lightning. Two of its buildings have decorated façades in Renaissance style — the Friedrichs-Bau and the Otto-Heinrichs-Bau. It contains several princely halls, a great watch tower, large balcony, dungeons, a museum with pictures and historic relics and a terrace from which a magnificent view is obtained. On this terrace is a statue of Victor von Scheffel, unveiled in 1891. In the town itself the principal buildings are the Gothic church of Saint Peter, the Gothic church of the Holy Ghost, the Roman Catholic Church, the university (q.v.), the town-house, the post-office, gymnasium, realschule and other schools. The manufactures, comparatively unimportant, include cement, tobacco, cigars, fire-extinguishing apparatus, shoddy, mathematical and surgical instruments, leather, etc., and there are also several breweries. One of the curiosities of the place is the well-known Heidelberg copper tun, kept in the cellar under the castle, and long ranking as the largest wine cask in the world, being 36 feet in length, 26 feet in diameter and capable of holding 49,000 gallons. Heidelberg has fine public walks. The gardens around the castle are well laid out, and at every turn present the finest views of the Neckar and the fertile and richly wooded valley through which it winds to join the Rhine. Behind the town and castle a carriage-road leads by easy ascent to the top of the Königstuhl, the loftiest hill of the district, from which an extensive view is obtained of surpassing beauty. Heidelberg arose around its 13th century castle and was until 1719 the capital of the Palatinate. It was long the centre of German Calvinism and gave its name to a famous Calvinistic catechism. The town suffered greatly during the Thirty Years' War. In 1622, 1688 and in 1693 the French captured and pillaged the city. In 1802 it was united to the grand duchy of Baden. Consult Godfrey, E., 'Heidelberg: Its Princes and its Palaces' (New York 1906); and Oncken, 'Stadt, Schloss und Hochschule Heidelberg' (Heidelberg 1885). Pop. (1910) 56,016.

HEIDELBERG CATECHISM, a religious work published at Heidelberg in 1563 by Zachariah Ursinus and Caspar Olevianus for the use of the Reformed Church, and published in the Palatinate. It was approved by the Synod of Dort, and was the model on which the Westminster Assembly framed the Shorter Catechism.

HEIDELBERG MAN. The most primitive human being known, represented by a jaw found in 1907 by O. Schœtensack at the base of the sands of Mauer near Heidelberg, Germany. The situation of this relic indicates by the association with it in the same deposit of appropriate animal bones, the second interglacial interval — a long, warm period estimated by Penck to have closed about 200,000 years ago. This jaw is extremely massive, lacks that frontal protrusion that gives shape to the human chin, and were it not for the unmistakably human teeth, which are excellently preserved, might be taken for that of an anthropoid ape. The teeth are essentially human and show no trace of being intermediate between the dentition of the anthropoid apes and man, although not very large and strong. The canines do not project beyond the line of the other teeth, even as much as in the Piltdown skull (q.v.). Seen from above the teeth form a perfect arch, whereas in anthropoid apes the grinding teeth lie in rows parallel to each other. The conclusion is that this jaw represents a race ancestral to the Neanderthal men of Spy, Krapina, etc.— men more primitive, powerful and apelike than they. «All agree,» says Osborn, «that Schœtensack's discovery affords us one of the missing links or types in the chain of human development.» (See STONE AGE). Consult Osborn, H. F., ‹Men of the Old Stone Age› (New York 1914).

HEIDELBERG UNIVERSITY, Germany, a renowned institution founded by Elector Rupert I in 1386. It was organized by Marsilius von Inghen on the model of the University of Paris, and at the Reformation, from a Catholic became a Protestant stronghold of learning. It flourished until 1622, when Tilly captured the town and the famous collection of manuscripts known as the Bibliotheca Palatina was removed to Rome. The university declined and suspended altogether in 1626. It was restored in 1652 and religious tests for professors were removed. The university again suspended in 1693, although instruction was continued at Frankfort in 1694 and at Weinheim in 1698. In 1700 instruction was resumed at Heidelberg, but the university led a precarious existence until 1802. In 1802 under the administration of the Grand Duke of Baden, a new era was inaugurated and the university rapidly became famous. It is very complete in its details, and comprises faculties of theology, law, medicine and philosophy; the famous library has over 500,000 volumes and 4,700 MSS. There are 196 professors and instructors, while the average annual attendance of students in all departments is over 2,300. Many of the most famous German scholars have been professors here— Melanchthon, Ursinus, Olevianus, Reuchlin, Œcolampadius, Spanheim, Puffendorf, Voss, Schlösser, Creuzer, Gervinus, Paulus, Kuno Fischer, Helmholtz, Bunsen, Blüntschli, etc. The quincentenary of the university was celebrated with elaborate ceremonial in 1886. Consult Buhl, H., ‹Zur Geschichte der Universität Heidelberg› (Heidelberg 1902); Hautz, ‹Geschichte der Universität Heidelberg› (Mannheim 1862–64); Weber, Georg, ‹Heidelberger Erinnerungen› (Stuttgart 1886).

HEIDELBERG UNIVERSITY, Ohio, coeducational institution at Tiffin, founded as a college in 1850, under the auspices of the Reformed Church in the United States and reorganized as Heidelberg University in 1890. It has departments of theology, liberal arts, commerce, oratory, art and music, and preparatory and summer schools. It confers the degrees of A.B., B.S., P.B. and B.L. In 1916 it had 38 professors and instructors; 650 students; a library of over 25,000 volumes; the grounds and buildings were valued at $400,000; the productive funds amounted to $360,000, and the income to $40,000.

HEIDENMAUER, hī'dn-mow-ĕr. (1) A name given in Germany to the remains of old German and Roman fortresses and ramparts, some of which still exist, especially at Ottilienberg, a hill of the Vosges, in Alsace. (2) The title of a novel by James Fenimore Cooper, who laid the scene of his story in the Vosges during the Middle Ages.

HEIDENSTAM, Verner von, Swedish poet and novelist: b. Olshammar, province of Nerike, 6 July 1859. He was at first destined to be a painter, but had to relinquish his studies at the Stockholm Art Academy because of ill health, which caused him to undertake extensive travels in southern Europe and the Orient. He was at once greeted as a poet of promise on the publication of his first collection of poems, *Vallfat och Vandrinasår*, 1888, which was followed by a second collection, ‹Dikter› (‹Poems›) in 1895. His poems and prose work are filled with a great joy of life, sometimes imbued with a love of Swedish history and scenery, particularly its physical aspects, that avoids none of the excesses of chauvinism. ‹Från Col di Tenda till Bloxberg› (1888), and ‹Endymion› (1890) are pictures of travel; ‹Hans Alienus› (1892) is a long poetic narrative; ‹Karolinerna› (2 vols., 1897–98) a series of historical portraits of King Charles XII of Sweden and his cavaliers. In ‹Klassizität und Germanismus› (published in German, Vienna 1901), Heidenstam advocates a sort of artistic exclusiveness, appearing as the champion of the classic spirit, which he considers essentially aristocratic, as opposed to the Germanic attitude which he considers democratic and reprehensible. In 1910 a savage controversy was waged in Swedish newspapers between a number of Swedish literary men, on the topic of the proletarian «degradation» of literature, the protagonists of the two opposing camps being August Strindberg (q.v.) and Heidenstam. Professors Lidforss and Böök also took part. Heidenstam's chief contribution was the pamphlet, directed chiefly against Strindberg, ‹Proletärfilosofians upplösning och fall› (‹The Decline and Fall of the Proletarian Philosophy›). Translations of short stories from Karolinerna will be found in the *American-Scandinavian Review* (New York), May 1914, November 1915, and July 1916. The first volume of that work has also appeared in England

JACOB WITTMER HARTMANN.

HEIFETZ, hī'fĕts, **Jascha,** Russian-Jewish violinist: b. Vilna, Russia, 2 Feb. 1901 (or 20 Jan. according to the Russian calendar). At a very early age he began to play the violin, and entered the Royal School of Music at Vilna when he was but five years old. He was graduated at eight, and went immediately to Petrograd, where he studied under Leopold Auer. His first public appearance was made at the age of five. He gave his first recital at Petrograd, before a large audience, at the age of nine, surprising his hearers by his facility and unusual genius of interpretation. Subsequently, he was soloist of the Symphony Orchestra at Pavlovsk; and later toured Europe. Coming to the United States, he made his first appearance at New York on 27 Oct. 1917. His audience was instantly charmed by the rare combination of the young violinist's skilful technique, lyrical quality of tone and intellectual grasp of his compositions. His tour through the United States has met with the warmest praise and commendation everywhere.

HEIGHTS, Measurement of. See HYPSOMETRY.

HEILPRIN, hīl'prĭn, **Angelo,** American naturalist: b. Satoralja-Ujhely, Hungary, 31 March 1853; d. New York City, 17 July 1907. He came with his parents to the United States in 1856, but received his education later in Europe, making a special study of natural history. On his return to America, his scientific ability was speedily recognized and he became successively professor of invertebrate palæontology and geology (1880–1900), and executive curator (1883–91) at the Academy of Natural Sciences, Philadelphia. From 1885 to 1890 he was professor of geology at the Wagner Free Institute. He was for five years president of the Geographical Society of Philadelphia, was leader of the Peary Relief Expedition in 1892, and made a journey of research to investigate the cause of the Mont Pelée (q.v.) disaster in 1902. His published works include 'Contributions to the Tertiary Geology and Palæontology of the United States' (1884); 'Town Geology'; 'The Lesson of the Philadelphian Rocks' (1885); 'Geographical and Geological Distribution of Animals' (1887); 'Explorations on the West Coast of Florida and in the Okeechobee Wilderness' (1887); 'The Geological Evidence of Evolution' (1887); 'The Animal Life of our Seashore' (1888); 'The Bermuda Islands: a Contribution to the Physical History and Zoology of the Somers Archipelago' (1889); 'Principles of Geology' (1890); 'The Arctic Problem and Narrative of the Peary Relief Expedition' (1893); 'The Earth and Its Story' (1896); 'Alaska and the Klondike' (1899); 'Mont Pelée and the Tragedy of Martinique' (1903); 'Tower of Pelée' (1905).

HEILPRIN, Louis, American scholar: b. Miskolcz, Hungary, 2 July 1851; d. 12 Feb. 1912. He was a brother of Angelo Heilprin (q.v.). In 1856 he came to the United States, where he was privately educated, and where he was connected with various works of an encyclopædic character. He published a valuable 'Historical Reference Book' (1884; 6th ed. 1899) in 'The Concise Knowledge Library.'

HEILPRIN, Michael, American author: b. Piotrkow, Russian Poland, 1823; d. New York, 10 May 1888. Carefully educated by his father, in his 20th year he emigrated to Hungary, chafing under Russian conditions. For a time he had a book-store at Miskolcz and was on intimate terms with Kossuth and his party. When the Revolution was quelled, he went to London, there meeting Kossuth, who advised him to go to America. In 1859 he and his family emigrated to New York, where his literary activity was continuous for nearly 30 years. As coeditor of Appleton's 'Annual Encyclopedia' and reviewer on *The Nation,* he won a distinct rank for his exact and versatile scholarship, especially in the line of Semitic literature. On the arrival of the Russian Jewish refugees in 1881–82, he took a prominent part in seeing to their welfare and personally supervised the colonization of many families. His published works include 'The Historical Poetry of the Ancient Hebrew,' (Vols. I and II, 1880); 'Bibelkritische Notizen. (1893).

HEIMBURG, hĭm'boorg, **Wilhelmine.** See BEHRENS, BERTHA.

HEINE, hī'nĕ, **Heinrich,** German poet: b. Düsseldorf, 13 Dec. 1797 (according to others, 1799); d. Paris, France, 17 Feb. 1856. His father, Samson Heine, of Hanover, was a merchant of honorable family which sprang from Bückeburg. He was good-natured but without marked intellectual gifts and of little business ability. The mother, Peira (Betty) van Geldern, came from one of the oldest and most prominent Jewish families on the Rhine. Her father, Gottschalk, was one of the first Jewish physicians who graduated as Med.D. from a German university; her brother, Joseph, was also a graduate. Her uncle, Simon van Geldern, was a strange, adventurous, enthusiastic man. He journeyed all through Europe, went to Jerusalem and returned from there to Germany after a varied and checkered experience. His diary of travel and other writings are still preserved. The fate of this strange relative made a deep impression on the mind of the mature and gifted boy, who first was sent to a private school and then to a lyceum in charge of priests until the year 1814. The greatest influence on his education was exercised by his intellectually gifted mother, who read Rousseau and Goethe and was an enthusiastic German patriot while his father was just as enthusiastic for Napoleon. Between these contrasts Heine in his youth, swayed constantly in both directions. The whole life of the poet can be described in one sentence: He was a German who was born of Jewish parents in a Roman Catholic city on the Rhine in the period of Napoleon's supremacy on the one hand and of flourishing romanticism on the other. In these words lies the entire biography of Heine, everything which uplifted and hampered, all his defects and excellences, and all the deep contrasts and dissonances with which his life was filled.

When he left the gynasium, he was ready with his companions to volunteer in the struggle against Napoleon. His first poems glorify German custom and loyalty, German patriotism. But this spirit soon changed, and soon, like so many eminent Germans of the time, he became one of the most enthusiastic supporters of the emperor's heroic figure, whose fame then filled the entire world. His most ardent wish at that time was to study. But his parents, whose business was already in decline, could not gratify this desire; and even his rich uncle, the celebrated banker, Solomon Heine, in Hamburg, on whose bounty the whole family in reality lived, preferred to have the youth become a clever merchant. So his father in 1815 took him to the

Frankfort Fair (Messe) and placed him there with the banking firm of M. G. Rindskopf. But the position was not long to Harry's taste nor was a grocery more endurable. After a short time he returned to Düsseldorf. The attempt was now made to have him settle in Hamburg, first in his uncle's counting-house and then in an independent concern of his own, which was a branch of his father's business. But he showed little talent as a merchant and in 1818 his firm failed.

In the three gloomy years at Hamburg, however, Heine became a poet. Under the pseudonym «Sy Freudhold Riesenharf» appeared in those days in a Hamburg magazine his first 'Traumbilder' and poems. A luckless love for his rich uncle's fair daughter Amelia filled his heart and aroused those lamentations of deep sorrow which formed the basis of his poetry. The well known poem, «A youth loves a maiden, who chose another» contained almost literally his entire heart's romance. After it was shown that Heine had absolutely no mercantile ability, his uncle finally consented that he might study law.

In October 1819 he entered the University of Bonn, which had just been reopened. A fresh and stimulating spirit prevailed at this university both among teachers and pupils. Men like August Wilhelm v. Schlegel, who interested himself very much in the young poet; E. A. Arndt and others, belonged to the teaching staff. Among the students we find names like Wolfgang Menzel, Hoffmann v. Fallersleben, Hengstenberg, etc. His special friends were Friedrich Steinmann, J. B. Rousseau and Josef Neunzig. In the vacation, after the first year of study, Heine resided in the little town Beuel, near Bonn, and there he worked on his first tragedy, 'Almansor,' the plot of which was placed in the period of Moorish decline in Spain. In the poem, however, Heine wished to present a picture of the battles which Judaism in Germany had to endure. 'Almansor' is a lamentation of crushed and persecuted Judaism. From Bonn Heine went to Göttingen, whose faculty of law was quite famous at that time. But he did not enjoy its instruction very long, for he had to leave the university on account of a duel, and in February 1821 came to Berlin.

His choice of Berlin was fortunate for the young poet. A vigorous intellectual atmosphere prevailed in that era in the Prussian capital. Before everything else he was attracted by the best salon in which Rahel Varnhagen von Ense had her special circle, with a coterie of brilliant spirits. Both she and her husband quickly recognized the poetical power in Heine and admitted him to close intimacy. Her brother, Leopold Robert, who was also a poet, was exceedingly friendly to him, and his wife Friedricka aroused Heine's enthusiastic adoration in sonnets and songs. The second coterie which fascinated Heine was a round table of young poets who gathered in Lutter and Wegener's restaurant, made famous by Ludwig Devrient and E. T. A. Hoffman, which was to become the scene of more than one carouse. These men were Christian Dietrich Grabbe, Friedrich v. Uechtritz, Karl Köchy, L. Gustorf and others. A third circle formed the greatest possible contrast to the others and in this, perhaps, Heine felt more at home. It was a small body of young men who in a time of general apostasy from Judaism, assumed as their task the reform and development of Judaism which then was regarded as in its decline. At the head of these resolute workers stood Eduard Gans, the celebrated jurist; Moses Moser, a merchant, whom his friend Heine called a living epilogue to Lessing's 'Nathan,' and Leopold Zunz (q.v.), the immortal founder of that branch of critical research called the science of Judaism. Heine took the deepest interest in the labors, hopes and disappointments of this society. A monument of his love for the general cause which was abandoned by them, is embodied in his romance 'The Rabbi of Bacharach,' which was then begun but unfortunately remains a torso. In Berlin, too, the university fairly fascinated him. In particular the philosopher Hegel (q.v.) made a deep impression on the young poet, whose first poems were issued by a Berlin firm in 1823 and aroused general interest, and he was termed a successor of Byron, the first poet of «Weltschmerz» in Germany. Varnhagen v. Ense and Karl Immermann, both famous writers of the time, showed special ardor in directing the public's attention to the young poet, the new star on the literary horizon, who was already arousing general comment by his 'Tragedie' (Almansor and Ratcliffe) as well as by his 'Lyrical Intermezzo' which appeared in a volume at the same publishers'. When Heine in 1824 went for a second time to Göttingen, in order to undergo his doctor's examination, he was already a well-known personality in literary circles. During this period of his second stay in Göttingen occurred an act on his part which is wholly unintelligible, judged by his previous labors, his writings and letters and which can only be explained by the sad conditions of the time — on 28 June 1825 at Heligenstadt, near Göttingen, he embraced the Protestant religion. Clearly this act was done only to promote his professional career, for his sympathies in increased degree remained on the side of his coreligionists. Heine regretted the step his entire life.

After his graduation as doctor of law he returned to Hamburg. But all his efforts to maintain his hold there or in Berlin were unavailing despite his baptism. The failure was due either to the prejudices of the time or to other drawbacks. So Heine devoted himself wholly to literature. Two years earlier he made a journey from Göttingen to the Harz Mountains, in the course of which he visted Goethe at Weimar, but met a rather cool reception. This journey he now described in his 'Harzreise,' which had many readers who were delighted with the new and fresh tone in which the varied and picturesque experiences were narrated. In the years 1826–31 Heine's rank as poet was firmly established. That period forms the crown of his life and activity — his high-water mark of achievement. The four volumes, 'Reisebilder' ('Pictures of Travel'), published 1820–31, showed him from an entirely different point of view. His 'Buch der Lieder' ('Book of Songs') gave on the other hand a faithful picture of his lyrical skill, which also struck entirely new paths. Heine had emerged from romanticism. He knew its mysteries and magic spells. Close thereby, or rather far above it,

HEINRICH HEINE

stood the well of German popular poetry, out of whose depths he drew such wealth as no other German poet had accomplished. Goethe and Uhland, Brentano and Wilhelm Miller were not without their influence on the matter as well as the metrical form of his poems; yet he was original and his songs aroused a practical revolution in the world of German poesy.

The secret of his originality and of the marvelous influence which he exercised not only on his contemporaries, but also on every age, lies in the peculiar charm which characterizes these songs, as they sound the tenderest tones of the heart, and then in cutting dissonances shatter the sentimental quality which is at their basis, thus producing a humorous-poetical effect incomparable in its way. The subjectivity with which Heine wove his sorrows, whether trivial or serious, in the warp and woof of his verse, was something unheard of in the history of German poetry. There was as little hypocrisy in his feeling of sorrow (Weltschmerz) as in that of Lord Byron, but it was truer and deeper, because it was blended with the Jews' sorrow from gray antiquity. His pictures and thoughts, his Oriental sensuousness and his German sensitiveness, all this in its combination formed a poetical *ensemble* which was to destroy romanticism, with its fairyland of legends and to construct the poetry of a new age and a new generation. The verse included a mass of new poetical material; for instance, the description of the sea in the splendid-colored North Sea pictures. In marked contrast was the wonderful effect produced by the form of the poems, which, apparently somewhat careless, was really intentional and just adapted to elevate the mood. With his 'Book of Songs' Heine became at once the first German poet of his time. His prose writings exercised in those days a similar influence. Heine loosened the tongue of the modern man of culture; he taught him what and why he suffers. In an age which was gloomy, depressed and poor in deeds, he unfurled the banner of freedom and announced to the young generation the dawn of new days which had to come. While much in his 'Pictures of Travel' was of transient worth and importance for the history of civilization, of permanent value was the blending of humor and sentiment, wit, and earnest reflection, wherein following his great predecessors, men like Laurence Sterne, Jean Paul and others he created an entirely new *genre*. The modern Feuilleton rest wholly on Heine's prose. The «Young Germany» school which gave the death-stroke to romanticism in the 30's of the past century followed in his steps. His travel picture and sketch remained for decades a model for young German writers after which to pattern their prose.

Despite his popularity, however, Heine could never attain a life of entire self-reliance in the conditions of his age. His steady dependence on his rich uncle, who let his nephew feel his power, embittered his stay in Hamburg. Accordingly in 1827 he accepted the offer of Cotta, the publisher, to assume the editorship of the Munich *Political Annals*. But he continued at this work only one winter; then he undertook a journey to Italy, which he described in his incomparable fashion in his 'Pictures of Travel.' He expected to receive on his return a professorship at the Munich University, which the Bavarian Minister Eduard v. Schenck desired to secure for him from the king; but owing to the intrigues of the clericals all efforts in Heine's behalf were unavailing. In 1828 he was recalled from his Italian trip by the news of his father's death — a man whom Heine had most tenderly loved. The following years were occupied in violent attacks on the poet August v. Platen and his followers, whom Heine regarded as his worst foes, besides literary labors and traveling. When the intelligence of the July Revolution in Paris reached him, the poet could no longer endure the home atmosphere, while the powerful Austrian Chancellor, Mettenich, who found refreshing youth «in the melancholy waters of his lyric,» warned him that he was not entirely secure from persecution. It was on a May day in 1831 when Heine forsook his fatherland, of course of his own accord, but in the firm conviction that sooner or later he would suffer the fate of all those who were leaders of freedom in Germany.

In Paris Heine labored from the very start at the great task of his life — to promote an understanding between the French and the Germans. His correspondence in the *Augsburger Allgemeine Zeitung,* his book on 'The Romantic School,' his contributions to 'The History of Religion and Philosophy in German,' are devoted to this great purpose. The first appeared in 1832 as 'French Conditions'; the others — with literary sketches, reflections on the drama and art, poems, etc., as 'Salon' (4 vols., 1832-36). The persecution which the German Diet set in motion against the «Young Germany» school of writers, leading to the ban against their works, was an act of mediævalism which affected the poet deeply. His only compensation was his recognition in his fatherland, the esteem in which he was held in France and the love of a beautiful young Frenchwoman, Mathilde Creszentia Mirat, whom he married in 1841, after having lived with her many years. Despite many storms and although his wife had no idea of her husband's eminence, the marriage was a happy one. The heavy material burden which she obliged Heine to assume forced him in 1836 to receive from the French government, when Guizot was head of the Ministry, a pension of 4,800 francs — a charity which France at that time bestowed on all prominent fugitives. It is to be understood, however, that Heine incurred thereby no obligation to praise or defend the political administration. Nevertheless, later he was violently attacked for this step.

The death of his rich uncle from whom he received an annual sum of 4,000 francs threw him into a terrible state. He was not mentioned in the will, and anxiety was added lest his cousin Carl Heine would refuse the further payment of his stipend unless he would submit his writings to a rigid censure by the family. Violent conflicts followed that cost the poet his rest and his health, which last had long been undermined. A severe nervous trouble had tortured him from his youth, and now as added illness came paralysis of the eye. In 1843-44 Heine visited his old mother in Hamburg. The poetical description of his journey in the winter tale 'Germany,' which appeared in 1846 with his 'New Poems,' and the epic poem 'Atta Troll,' which was issued in 1837, showed an entirely new line of poetical genius; for both these satirical epics are pearls of poesy. Since 1848 Heine was practically chained to his bed of illness — his famous "mattress grave." He bore his sufferings, however, with true heroism; his intellectual power was not weakened. But a great religious change took place which led him back through the Bible to belief in God and to the memories of his race. The two great works of the last period of his life, 'Romancero' (1851) and 'Confessions' (in 'Lutetia,' 3 vols., 1854), are proofs of this great change, both in poetry and prose. Once more did the poet reveal himself to his admirers in agonizing strains of sorrow, in classical ballads, in Hebrew melodies, in profound lamentations of vivid effectiveness. Once more steps the great writer before us, and in prose of the loftiest beauty and strength he seeks to answer the most vital questions of our human existence.

On 17 Feb. 1856 he died after much suffering. He rests at Montmartre, next to his wife. His grave is adorned with a monument, the work of the sculptor Hasselriis. An artistic memorial was erected by an enthusiastic admirer, the late Empress Elizabeth of Austria, at her country palace Achilleion, near Corfu in the Ionian Sea, with its classic memories. The continued efforts, however, made to place a memorial to the poet in his home on the Rhine have so far been fruitless, and have but led to bitterest conflicts between clericals and anti-Semites on the one side and the large body of his admirers on the other. It is not without significance that the Lorelei fountain, which could find no lodgment in Germany, has been placed in New York, the metropolis of the United States, a country where Charles G. Leland's translation of the 'Pictures of Travel' appeared in 1855, and where the poet's works have appeared in numerous editions and translations. The poet's body of admirers grows from day to day, and with this vast congregation of thoughtful men and women in every land the history of literature, judging without prejudice, gladly recognizes Heine as the greatest German lyric poet, after Goethe, and as one who is and will remain among the most illustrious poets in the world's literature.

Bibliography.— Although the first collected edition of Heine's works by A. Strodtmann (22 vols., Hamburg 1861–66) was not brought out until some time after his death, there have been published very many other editions since then. Of these the most important are by G. Karpeles (Hamburg 1885 and Berlin 1893) and by E. Elster (Leipzig 1887–90). There have been almost innumerable editions of his separate works. A very large number of his poems have been set to music, not only by German composers, but also by composers in many other countries. Almost equally as numerous are the translations of his works into different languages, especially into English and French. Of his collected works the most important translations are 'Oeuvres Complètes' (14 vols., Paris 1852–68) and 'The Works of Heinrich Heine' (13 vols., New York 1892–1905). There are also a number of English translations of his poems, the most recent and in many respects the best and most careful being that by Louis Untermeyer (New York 1917). Both books and magazine articles on Heine's work and life have been written in vast numbers in many languages. A very careful and exhaustive bibliography of these is to be found in Goedeke, K., 'Grundriss der Deutschen Dichtung' (Vol. VIII, Dresden 1908) which also contains a very complete list of editions and translations. Consult Amiot, C. G., 'Henri Heine et la Guerre Actuelle' (in *Revue Hebdomadaire,* Vol. VI, p. 214, Paris 1916); Arnold, Matthew, 'Essays in Criticism' (1st series, New York 1883); Bartels, A., 'Heinrich Heine' (Dresden 1906); Bienenstock, M., 'Das Jüdische Element in Heines Werken' (Leipzig 1910); Brandes, G., 'Main Currents in 19th Century Literature' (6 vols., New York 1906); Brauweiler, E., 'Heines Prosa' (in *Litterarhistorische Gesellschaft Bonn, Schriften* N. F., Vol. IX, Berlin 1915); Dowden, E., 'Essays, Modern and Elizabethan' (New York 1910); Eliot, George, 'Essays' (London 1884); Embden, L. van, 'Heinrich Heines Familienleben' (Hamburg 1892); Frank, M. M., 'When Heine was Twenty-one' (in 'Short Plays about Famous Authors,' New York 1915); Fürst, R., 'Heinrich Heines Leben, Werke und Briefe' (Leipzig 1910); Howells, W. D., 'My Literary Passions' (New York 1895); Karpeles, G., 'Heinrich Heine' (Leipzig 1899); Keiter, H., 'Heinrich Heine' (Köln 1906); Lichtenberger, H., 'Henri Heine Penseur' (Paris 1905); Plotke, G. J., 'Heinrich Heine als Dichter des Judentums' (Dresden 1913); Reu, H., 'Heine und die Biebel' (Munich 1908); Sachs H. B., 'Heine in America' (in *Americana Germanica,* No. XXIII, Philadelphia 1916); Samuel, H. B., 'Modernities' (New York 1914); Selden, C., 'Les derniers jours de Henri Heine' (Paris 1884); Stigand, W., 'Life, Work and Opinions of Heinrich Heine' (2 vols., London 1875); Stork, C. W., 'Heine and Tennyson' (in *Haverford Essays,* p. 153, Haverford 1909); Treitschke, H. von, 'History of Germany in the 19th Century' (4 vols., New York 1915–18); Vacano, S., 'Heine und Sterne' (Berlin 1907); Walter, H., 'Heine, the Political Refugee' (in *McGill University Magazine,* Vol. XVI, p. 484, Montreal 1917).

Gustav Karpeles,
Author of 'Jewish Literature and other Essays.'

HEINEMANN, hī'ne-man, **William,** English publisher and author: b. Surbiton, 18 May 1863. He founded the publishing house which bears his name in 1890. He has published under the pen name of "Kassandra Vivaria" 'The First Step,' a play (1895); 'Summer Moths,' a play (1898); 'War, a play (1901).

HEINRICH VON OFTERDINGEN. This fragmentary romance by Novalis (Friedrich van Hardenberg), written 1799–1800 and published by Tieck after the author's death (1801), is the masterpiece of early German Romanticism, the supreme representation of Romantic thought and feeling. The novel was planned consciously to be both a supplement to Goethe's 'Wilhelm Meister' (q.v.) and a refutation of it; the tendency of 'Wilhelm Meister' seemed to the Romanticists to be too prosaic and practical. 'Heinrich von Ofterdingen' was to be the glorification of the poetry of life; poetry and life are actually identical; poetry is the pathway to all wisdom. Novalis presents his theme in a symbolic tale, which relates the life of an ideal poet: indeed, the whole substance of the story is included in the two phrases, substantially identical in meaning: «Heinrich becomes a poet,» and «The world becomes a dream.» Various experiences are provided for the shaping of the hero's gifts; the culmination of the first period is reached in love and grief, these experiences being directly connected with Novalis's love for Sophie von Kühn and his sorrow at her death.

'Heinrich von Ofterdingen' is divided into two parts: «Expectation» and «Fulfillment,» but pathetically enough the author died leaving the second part a fragment; the continuation, so far as we know it through Novalis's notes and Tieck's account of his friend's plans, presents a strange but fascinating medley of miracle, symbol and mysticism.

In the first chapter of the novel the hero related a dream, the vision of the Blue Flower, and the romance consists essentially in the symbolic quest for this flower, which Heinrich ultimately plucks. Through the influence of 'Heinrich von Ofterdingen' the Blue Flower became the symbol of Romantic longing, the realization of the poet's dream, the union of the dream-world and the real world. The hero has only his name in common with a legendary poet of the Middle Ages, who appears in a Middle High German poem «Der Wartburgkrieg» («The Wartburg Contest»), and is used by Wagner in 'Tannhäuser' and elsewhere in modern mediævalistic literature, as by Lienhard, Kastropp and others. Translation, Cambridge, Mass., 1842. For criticism consult Brandes, 'Romantic School in Germany'; Wernaer, 'Romanticism and the Romantic School in Germany' and Haym, 'Die Romantische Schule.'

Harvey W. Thayer.

HEINTZELMAN, hīnt'sĕl-man, **Samuel Peter,** American military officer: b. Manheim, Pa., 30 Sept. 1805; d. Washington, D. C., 1 May 1880. Graduated at the United States Military Academy 1826, and served during the Mexican War. In 1861 he commanded a division at Bull Run, where he was wounded 21 July. Afterward promoted brigadier-general of volunteers, Heintzelman, during the organization of the army in the winter of 1861–62, held command of a division. On the moving of the Army of the Potomac, in March 1862, the 3d Army corps was placed under his command. His corps formed the right wing of Pope's army at the second battle of Bull Run, 30 Aug. 1862. During the Maryland campaign he commanded the defenses at Washington, and was afterward appointed to the command of the Department of Washington, and of the 22d Army corps, which he held during the battles of Chancellorsville and Gettysburg, in May and July 1863. He retired in 1869, with the rank of major-general.

HEIR (Lat. *hæres*), in law, one entitled by descent and right of blood to lands, tenements or other hereditaments. Hence it is an ancient apothegm, that «God only can make an heir.» An heir is really one who is born or begotten in lawful wedlock, and on whom the law casts the estate, in lands, tenements or hereditaments immediately on the death of his ancestor. The rights of heirs in the majority of the United States are determined by the principles of the common law unless specially modified by statute. It is a matter of judicial decision that the rights of heirs in the United States are statutory only. Hence they cannot plead, for instance, that an inheritance tax is unconstitutional. An heir presumptive is one who will be the heir at the death of the owner, as the elder son of a deceased brother in England, or all the children of a brother in the United States, where the owner has no children; for they will be heirs if he dies without issue. As an heir presumptive may lose his heirship by a change of circumstances, he does not become an heir apparent so long as this change is legally probable, though physically or naturally impossible. Thus the nephew of the owner can never be his heir apparent, however aged or feeble or near to death the owner may be; for in contemplation of law it is always possible that a son may be born to him, who would be an heir apparent, and who would therefore supersede an heir presumptive. An heir apparent is one who must be the heir if he survive the owner, as the eldest son in Great Britain, or all the children in the United States.

HEIRLOOM, in English and Scots law, a chattel, as furniture, which by will, law or the like descends to the heir with the land; also, any chattel owned by a family for a number of generations. Usually the term includes tables, beds, pans, carts, etc., but it may include ornaments, as jewels. Formerly the term was of more importance than it is to-day. An owner of an heirloom cannot convey it away from the estate, for at his death it goes to the heir or devisee. In popular usage to-day the term is used as synonymous with settled chattels.

HEISS, hīs, **Michael,** American Roman Catholic prelate: b. Pfahldorf, Bavaria, 12 April 1818; d. Milwaukee, 26 March 1890. He studied at the University of Munich and at the Catholic seminary at Eichstädt, and was ordained in 1840. In 1843 he came to the United States, and was first assigned to a church in Covington, Ky.; he next went to Milwaukee as missionary priest and secretary to the bishop. In 1868 he was consecrated as the first bishop of La Crosse, Wis.; in 1880 he was appointed coadjutor to the archbishop of Milwaukee, with the right of succession, and in 1881 became archbishop of Milwaukee. He took an important part in American councils, and was a member of the Vatican Council (1860–70). He wrote 'The Four Evangelists,' and a treatise on marriage (in Latin).

HEISTAND, hī'stand, **Henry Olcot Sheldon,** American soldier: b. near Richwood, Ohio, 30 April 1856. He was graduated from West Point 1878, and was assigned to 11th United States Infantry as second lieutenant. He was appointed government inspector and instructor Ohio National Guard in 1892, and during the Presidential campaign of 1896 was confidential secretary to McKinley. In 1889 was appointed military commissioner to the Paris Exposition of 1900; while on that duty was promoted lieutenant-colonel in 1900, and became adjutant-general and chief of staff in the China expedition for relief of Peking 1900. Has served as adjutant-general at all important military headquarters, including Manila, San Francisco, New York city and Chicago. He has written 'Alaska, Its History and Description' (1898) and numerous professional papers and brochures.

HEJAZ, hĕ-jäz, or **HEDJAZ,** Arabia, since November 1916, a kingdom of which Mecca is the capital. It comprises the former vilayet of Hejaz, extending from Akaba in the north to Asia in the south; the area is about 96,500 square miles bordering the Red Sea littoral and is a region of desert and oases. There are, however, many populous coastal towns connected by the Hejaz Railway with terminals at Mecca and Medina. The population numbers about 300,000.

History.— In June 1916 the Grand Sherif El Hussein ibn Ali of Mecca, with his three sons, revolted against the Turkish authorities and within two months was master of the principal towns. On 27 June he proclaimed his independence of Turkey. The first result of the revolution was the opening of the ports on the eastern shore of the Red Sea, which had been closed by Turkey, for trade with the ports of the Entente Allies, particularly those of Egypt on the opposite shore. Early in September the French government, in full accord with the government of Great Britain, dispatched a delegation of French Moslems to the Grand Sherif of Mecca with the mission of congratulating the new Arabian government on its deliverance from Turkey. It was also the bearer of a substantial sum of money (about 3,000,000 francs) for the purpose of rendering financial aid to the new state. The French government also furnished a vessel for the British and French Moslems in which to resume their annual pilgrimages to Mecca by way of Jedda. Thousands of such pilgrims took advantage of this free service and it proved an important factor in the development of Franco-Arabian relations. When the date of the pilgrimage drew near the Grand Sherif sent out circulars inviting all «true believers» to come to Mecca. Those pilgrims found a new Mecca, a cleaner city and free of the assassins and robbers of former years. In November 1916 the Grand Sherif assumed the title and office of king at the request of the Ulema and notables of Mecca, approved by the unanimous vote of the people, and has been recognized as king of Hejas by the Allied governments. See Arabia; Mecca; Turkey; War, European. Consult 'Current History' (New York October 1916); 'Statesman's Year Book' (1918).

HEJRA, or HIJRA. See Hegira.

HELEN, in Greek legend, the most beautiful woman of Greece, daughter of Zeus by Leda. By advice of Ulysses her numerous suitors were bound by oath to respect her choice of a husband, and to maintain it even by arms. She chose Menelaus, but was afterward carried off to Troy by Paris, the Trojan War arising from the claim made by Menelaus for the fulfilment of the oath. After the death of Paris she married his brother Deiphobus. On the fall of Troy she returned to Sparta with Menelaus, but at his death was driven from the country, and was murdered at Rhodes by the queen of that island.

HELENA, hĕl'ĕ-nạ, **Saint,** the mother of the Emperor Constantine the Great. She was of humble origin, probably the daughter of an innkeeper of Bithynia. She captivated Constantius Chlorus, and became his wife; but when Diocletian elevated him to the dignity of Cæsar, in 292 A.D., he was compelled to repudiate her. The succession of her son, and the influence she had exercised in educating him as a Christian, compensated her for previous humiliations, while her piety and zeal for the propagation of Christianity have made her a saint in the Roman Catholic calendar.

HELENA, hĕl'ĕ-nạ, or hĕ-lē-nạ, **Ark.,** city and county-seat of Phillips County, on the Mississippi River, and on the Saint Louis, Iron Mountain and Southern, the Yazoo and Mississippi Valley, the Missouri and North Arkansas railroads, and is the terminus of the Arkansas Central, about 75 miles below Memphis and 95 east by south from Little Rock. It has boat communications with all important river-ports. A conflict between the Federal and Confederate forces took place here 4 July 1863. The Union army, about 4,500, was under General Prentiss, the Confederate, about 9,000, under General Holmes. The Confederate loss was about 1,800, including killed, wounded and prisoners. Helena is in an agricultural and lumbering region; the chief manufactures are lumber, cottonseed oil and foundry products. It has cotton-compresses, a shingle-mill, box factories, stave mills, railroad shops, manufactories of chairs, brooms, spokes and handles, brickyards and large lumber-yards. Some of its educational institutions are the Jefferson High School and the Sacred Heart Academy; it has several banks, a public library, a number of fine church buildings. It contains also several monuments to Civil War heroes and the United States district, State, county and municipal courts. Pop. 10,796.

HELENA, Mont., city and capital of the State and county-seat of Lewis and Clark County, on the Northern Pacific and the Great Northern railroads, about 70 miles north by east of Butte. The city is surrounded on all sides by the Rocky Mountains; on the south and west the mountains are within two miles of the city, while to the north there is a wide valley between the city and the foothills, and the same condition exists on the east. The city is protected from severe wind storms, and in the winter season there is a difference between its temperature and that of the mountain country of from 10 to 20 degrees. The country tributary to Helena is rich in both mineral and agricultural resources. The mines are principally gold-producing, while the products of the farms are cereals and the ordinary vegetables. Also tributary to the city are large areas devoted to the raising of cattle and horses, but this industry is gradually being replaced by diversified farming. Helena is the richest city per capita not only in Montana but in the entire Rocky Mountain country. It is principally a city of homes; cattlemen, miners and others engaged in industries elsewhere in Montana make it their residence because of its church, school and social attractions.

The original of Helena was «Last Chance Gulch»; the town came into existence as a result of discoveries of placer gold in 1864, by four prospectors, John S. Cowan, John Crab, D. J. Miller and Robert Stanley, who came from Alder Gulch, now Virginia City, in the southern part of the State. On 16 July 1864 they sunk two holes to bed rock and in each they found gold. It was the «Last Chance» that turned out favorably and that was the name of the camp until Helena was adopted. The news of the find spread; soon there were

500 men in the camp; such was the nucleus of the present capital.

The educational institutions are the public and parish schools, the Montana Wesleyan University (Methodist), Mount Saint Charles College, Saint Vincent Academy (Catholic) and the State, city and other libraries. Among the principal buildings are the government building, costing $500,000, State Capitol (cost, with the two new wings, $1,100,000), County Courthouse (cost, $100,000), High School building ($150,000), Saint Helena Cathedral ($400,000), Y. M. C. A. building ($115,000), and seven graded school buildings valued at $250,000. There are also Saint John's Hospital, Saint Peter's Hospital, Saint Joseph's Orphanage, House of the Good Shepherd, several fine churches, Masonic Home and the Odd Fellows' Home. All secret societies are well represented, the leading one being the Masonic fraternity which owns two temples. The city is noted for its clubs, the Montana, Lambs and Elk's being social organizations, and the Helena Commercial Club one of the most active bodies in the West. On the Missouri River, 12 miles from Helena, are located the great power dams of the Montana Power Company, one being located at Canyon Ferry, one at Hauser Lake and one now in process of construction at Holter. These three dams furnish an aggregate of 110,000 horse power which is electrically transmitted to Helena for operating street cars and lighting the city and for manufacturing purposes. Helena is the principal financial centre of the State and has the distinction of having the largest per capita bank deposits of any city in the country. It is also one of the mining centres of the State. The principal gold mines now working within three to eight miles of the city are the Franklin, The Scratch Gravel Gold Mining Company. The Eastern Belle Gold-mining Company in the Scratch Gravel District, the Carbon Hill Mining and Milling Company and the Stem Winder Company in Grass Valley, The Whitlatch Union, The Butte and Helena Whitlatch and the Yellow Boy Mine. The districts tributary to Helena in which mining is active are the Marysville district, the Rimini district, the Lump Gulch, Clancy, Wickes, Corbin, Radersburg, York, Winston, Hassel and Townsend districts, in all of which are producing mines. In the 20 years after the first discovery of gold $25,000,000 were taken from the ground on which is now located the business part of the city, and it is no unusual thing at the present time, when the foundation for a new building is being prepared, to strike gold in the excavation. This was the case when the excavation was made for the Placer Hotel four years ago, the contractor for the work securing more than $1,000 from the bed rock on which the foundation is placed.

The government is of the commission form, being vested in a mayor and two councilmen who appoint all subordinate officials. The assessed property valuation is about $15,000,000. Helena has one of the most extensive ornamental lighting systems in the State. Leading away in all directions to scenic points is a system of splendidly constructed roads, notable among which are the Le Grande Canyon boulevard and the Transcontinental automobile route over Priest's Pass of the main range of the Rocky Mountains. Helena has been the capital of Montana since 1869. In that year the capital was removed by popular vote from Virginia City. After Montana was admitted as a State two elections were held for the permanent location of the capital and in 1894 Helena was chosen. Its altitude is 4,200 feet. The climate is not severe, the locality having the distinction of possessing the longest season between frost and frost of any section of the State. The average temperature in January and February, the two coldest months in the year, is 20 degrees above zero, with little moisture in the air. In summer the average temperature is 75 degrees. Pop. 15,000.

L. M. Rheem.

HELENA, Battle of. Helena, Ark., is on the west bank of the Mississippi River, about 82 miles below Memphis. Since 13 July 1862, when General Curtis arrived there from western Arkansas, it had been occupied by Union troops, and on 4 July 1863 was held by a division of the 13th corps, under General Salomon, and a brigade of cavalry, in all 4,129 effective men, under command of Gen. B. M. Prentiss. The place is surrounded by hills, and those nearest the city were occupied by strong redoubts; Graveyard Hill in the centre, Fort Righter on the north or right, and Fort Hindman on the south or left, were all connected by a line of bastions and rifle-pits, both ends of which rested on the river. In the river lay a gunboat. Toward the middle of June it was determined by the Confederates to take the place, whereby it was hoped to raise the siege of Vicksburg or, if Vicksburg fell, still to keep the river closed. General Holmes was ordered to move from Little Rock with about 7,600 men, Price's and Marmaduke's divisions, Fagan's brigade of infantry and Walker's brigade of cavalry. Holmes bivouacked about four miles from Helena on the evening of 3 July, and at midnight advanced to within a mile of the outer works. The assault was ordered at daylight. On the Confederate right Fagan with 1,770 men advanced on Fort Hindman, carried all the outer entrenchments and made a desperate attempt to take the fort, but was repulsed with a loss of over 400 men. On the Confederate left Marmaduke's division of infantry and Walker's cavalry brigade, aggregating 2,780 men, attacked Fort Righter and were repulsed. Price, in the centre, with 3,100 men, made a strong assault, carried all the entrenchments in his front, seized Graveyard Hill, and ordered one brigade to move on the town and another to assault Fort Hindman in the rear, but the Union troops checked the advance of the two brigades and drove them back and, the attacks on the right and left being repulsed, the fire of the forts, rifle-pits and gunboat was concentrated on Price, and at 10.30 A.M. Holmes gave the order to withdraw and led his troops back to Little Rock. The Union loss was 57 killed, 146 wounded and 36 missing; the Confederate loss was 173 killed, 687 wounded and 776 missing. Consult ‘Official Records’ (Vol. XXII); Greene, ‘The Mississippi’; The Century Company's ‘Battles and Leaders of the Civil War’ (Vol. III).

HELENIN, a chemical substance extracted by hot alcohol from the root of the elecampane (*Inula helenium*). It has the formula C_6H_8O, and is nearly insoluble in water, but very soluble in alcohol. The first crystals obtained from the root-extract contain considerable quantities of inula-camphor; but this may be removed by repeated crystallization from alcohol. Pure helenin crystallizes in white prisms or needles, melting at 232° F.

HELICIDÆ, hē-lĭs'ĭ-dē, the family of terrestrial pulmonate mollusks which includes most of the land and many fresh-water snails. See SNAILS.

HELIGOLAND, hĕl'ĭ-gō-lănd, or **HELGOLAND**, hĕl'gō-länt (Dan. «holy land»), a small island fortress and popular sea-bathing resort in the North Sea, belonging to Germany, situated about 40 miles northwest of the mouth of the Elbe. It is about a mile long and one-third of a mile broad, and has an area of about one-quarter of a square mile. It consists of two parts, the Oberland, a flat-topped rock 206 feet high, which since the island was acquired by Germany has been made into a great fortress, from which visitors are excluded. The Unterland is a small stretch of shore at its foot. There are two ports, one on the north and one on the south side, and most of the houses stand on the Oberland. The Unterland gives partial shelter to the shipping. Steamboats ply between the island and Hamburg. The principal buildings are the church, lighthouse and a royal Prussian biological station for the study of the fauna and flora of the North Sea. The bathing facilities, which attract so many visitors, are found in a dune or sandbank separated from the main island by a channel about a mile wide. This Sandy Island, as it is called, is slowly being reduced in size by the inroads of the sea. The inhabitants are chiefly employed in fishing, and speak a Friesian dialect. The island has cable communication with Cuxhaven and Wilhelmshaven. Christianity was first preached here by Saint Willibrod in the 7th century. Taken from the Danes in 1807, it was ceded to Great Britain in 1814, but was transferred to Germany in 1890. The island was formerly much larger than now, but has been cut away by the attack of the waves. (See SHORE LINE). The Bight of Heligoland was the scene of a naval engagement between German and British ships on 28 Aug. 1914, which ended in a British victory. The island held a prominent place in German naval strategy. See WAR, EUROPEAN.

HELIOCENTRIC, hē"lĭ-ō-sĕn'trĭk, «having the sun as centre,» a term applied to the Copernican system, as in opposition to the Ptolemaic system, which was geocentric, that is, «having the earth as centre» of the solar system. In modern astronomy the word is applied to calculations in which the sun is referred to as centre of the planetary system. Thus the heliocentric place of a planet is the position it would occupy at a given time when calculated from a point of view in the centre of the sun.

HELIODORUS, hē-lĭ-ō-dō'rŭs, the earliest of the Greek writers of romance: b. Emesa, Syria, and lived near the end of the 4th century. He became a believer in the Christian religion, and bishop of Tricca in Thessaly. His youthful work, 'Æthiopica (that is, Æthiopic Affairs), or the Loves of Theagenes and Charicleia,' is a tale in poetical prose, with an almost epic tone. It is distinguished by its strict morality from the other Greek romances, and interests the reader by the wonderful adventures it recounts. One of the best editions is that of Hirschig in the 'Erotici Scriptores' (1856). An English translation by R. Smith appeared in 1855. See ÆTHIOPICA.

HELIOGABALUS. See ELAGABALUS.

HELIOGRAPH, a signaling instrument using the direct rays of the sun for the transmission of orders or information. The essential parts of the instrument are the mirror which reflects the light, and a telescope so attached to the mirror as to direct the reflected ray to the point where it is to be read. When the position of the sun is such that the ray forms an angle greater than 90 degrees at the mirror, a second mirror is introduced to prevent an undue dispersion of the beam of light. The instrument is mounted on a tripod with a ball and socket joint, and is accurately set with adjusting screws. The code in common use is the Morse telegraph alphabet of dots and dashes, formed by alternately obscuring and displaying the flash from the mirror. In military use special codes are employed. The heliograph is available only when the sun is shining in a clear sky.

HELIOMETER, an instrument for measuring small angular distances on the sky, with very high accuracy, particularly the distance of a planet from a nearby star, and the angular distances of neighboring stars from each other. It is from the former kind of measures that until very recently the most accurate determination of the distance from the earth to the sun was deduced: from the latter the distances to certain of the stars were determined with a higher accuracy than was possible in any other way. The heliometer of Bouguer is an astronomical telescope provided with two object-glasses, one of which is movable, and which form two distinct images of the same object, visible through the same eye-glass. A single object-glass cut into two parts, which are relatively movable by a screw, is always employed now. If, in contemplating a celestial body, the object-glasses are placed so as to bring the images to touch each other, the distance of the centres of the glasses gives the diameter of the image. In this manner the instrument gives, for instance, the difference of the diameter of the sun in perigee and apogee. For many decades the heliometer has stood at the head of all astronomical instruments for the precision of its results, especially in the measurement of the parallaxes of the stars and of the sun. Very recently, however, it has been almost wholly superseded for these purposes by the photographic plate, with which as high, or even a higher, accuracy can be attained with a greatly lessened expenditure of labor.

HELIOPOLIS, hē-lĭ-ŏp'ō-lĭs («City of the Sun»), Egypt, the On of the Hebrew Scriptures, on a site now partly occupied by Matariah, six miles northeast of Cairo, was one of the most ancient and extensive cities during the reign of the Pharaohs, and so adorned by monuments as to be esteemed among the first sacred cities of the kingdom. During the flourishing ages of the Egyptian monarchy the priests and scholars acquired and taught all the learning of the Egyptians within the precincts of its temples. Its sacred name was Per-Rê (house or city of Rê), of which Heliopolis is the

Greek translation. It may be regarded as having been the university of the land of Misraim, and at the time of Strabo, who visited this town 24 B.C., the apartments were still shown in which, four centuries before, Eudoxus and Plato had labored during 13 years to learn the philosophy of Egypt. Solon and Thales were also reputed to have visited its schools. Here Joseph and Mary are said to have rested with the infant Jesus. Near the village stands the Pillar of On, a famous obelisk, supposed to be the oldest monument of the kind existing in Egypt. Its height is 67½ feet, and its breadth at the base 6 feet. Hieroglyphical characters are sculptured upon it, but are partly illegible. The obelisks known as Cleopatra's Needles, of which one is now in London and the other in Central Park, New York, were originally erected at Heliopolis by Thothmes III. A fierce battle was fought here, 20 March 1800, between the French under Kleber and the Turks, when the latter were defeated. Consult Pauly-Wissowa, 'Real-Encyclopädie der classischen Altertumswissenschaft' (Vol. VIII, Stuttgart 1913).

HELIORNITHIDÆ, hē-lĭ-ôr-nĭth'ĭ-dē, a family of tropical birds, the fin-foots or sun-birds, placed by some ornithologists among the *Cecomorphæ*, and by others, more probably, with the rails. They are about a foot long, mottled brown and white, with long pointed wings and long stiff tails; and frequent the borders of forest streams and ponds, in which they spend much of their time swimming and diving. They feed on small fish, crustaceans, insects and seeds. The best-known species is *Heliornis fulica* of southern South America.

HELIOS, hē'lĭ-ŏs, in mythology, the god of the sun (Latin, *Sol*) in the Greek mythology; son of Hyperion and Theia, and brother of Eos (Aurora, the dawn) and Selene (Luna, the moon). He is frequently called by the name of his father. He dwells with Eos in the ocean behind Colchis. From the portals of the morning he rides through the air in an oblique curve to the gates of evening, and after having cooled his horses in the ocean, he drives his chariot into a self-moving golden vessel, made by Hephæstus (Vulcan), which with wonderful rapidity bears him during the night along the northern shore of the ocean back to Colchis, where he bathes his horses in the lake of the Sun, and rests till the dawn of the morning. Other accounts represent him as making this nightly passage while slumbering in a golden bed. His horses and chariot are first mentioned in the Homeric hymn on Helios. Among events in the history of Helios the poets relate his contest with Poseidon for the Isthmus of Corinth, his revealing the secret amours of Ares and Aphrodite, and his disclosure to Demeter of Pluto as the ravisher of her daughter. This idea of his omniscience seems to have been the reason why he was confounded and identified with Apollo, though they were originally quite distinct. As he was descended from the race of the Titans he is often called Titan. The famous Colossus of Rhodes was a representation of Helios. Consult Fairbanks, 'The Mythology of Greece and Rome' (1907).

HELIOSTAT, hē'lĭ-ō-stăt, an instrument designed to reflect the rays of the sun, or the image of a heavenly body steadily in a given direction notwithstanding their apparent motion relative to the point of observation. It consists of a mirror mounted on an axis made parallel with the axis of the earth, and caused to rotate toward the west with a velocity equal to the angular velocity of the sun or other body being observed. Several forms of the instrument have been devised, the best known being Silberman's; and this too has been variously modified. Aside from its former use in physics, the heliostat has become a valued adjunct to the horizontal telescope, serving to reflect the images of the heavenly bodies into the object glass. (See TELESCOPE). Consult article on the heliostat in *Popular Astronomy* for November 1913. An adaptation of this instrument is used in geodetic surveying to keep a point of reference constantly in view.

HELIOTHERAPY, the treatment of disease by the action of sunlight. See PHOTOTHERAPY.

HELIOTROPE, hē'lĭ-ō-trōp, a genus (*Heliotropium*) of plants of the borage family, characterized by the undivided ovary prolonged into a style, many of whose species have vanilla-scented blossoms. The one most cultivated is a small shrub (*H. peruvianum*), originally South American, which has small fragrant flowers growing compactly in one-sided spikes. Cuttings taken from the young branches grow readily, and come soon into blossom. The heliotropes are natives of warm climates, and very numerous, several growing wild in the United States. Many delightful varieties have been produced as garden and greenhouse flowers.

HELIOTROPE, the bloodstone, is a variety of quartz partaking of the character of jasper and of chalcedony. It is of a deep green color, and is covered with red spots like drops of blood. Many fine antique Greek and Roman intaglios and cameos, also seal rings carved in bloodstone, are preserved in the great gem collections. It is found in Tartary, Persia, Siberia, Colorado, Georgia, Oregon and Orange County, N. Y., in the island of Rum, Scotland, and many other places. It received the name heliotrope, or as some of the older writers give it, elitropia, because it was said that if the mineral be put into water contained in a basin rubbed with the juice of the plant heliotrope, and be exposed to the sun, the water will appear red and the sun blood-like, as if it was eclipsed.

HELIOTROPISM, hē-lĭ-ŏt'rō-pĭzm, or **PHOTOTROPISM**, the influence and effect of sunlight on organisms. When a seedling plant is placed in a transparent vessel of water within reach of the light of a window, the stem and leaves gradually bend toward, and the roots from, the light. The former phenomenon is termed positive, and the latter negative, heliotropism. The shoots and leaves of nearly all plants turn toward the light, and the turning of the sunflower toward the sun is familiar to every one. In the case of organs which are positively heliotropic the growth of the side next the light is retarded, and that of the opposite side increased; the result of these combined actions is a concavity on the former, and a convexity on the latter, thus causing a curvature toward the light. In the case of roots these actions are reversed. That these results are brought about by the action of light is evident; the cells on the concave side become less, while those on the convex side become more, turgid, thus forcing the organ to bend; but the cause of turgescence is unknown.

In animals a similar heliotropism is operative and is plainly manifested in some low forms, as hydra, where it is of great service in their almost automatic food-getting. Heliotropism is closely allied to, and much modified by chemotropism (q.v.) and other influences.

HELIOZOA, hē″lĭ-ō-zō′a̤, the «sun animalcules,» an order of rhizopods (q.v.) with or without silicious skeletons, and having slender and radiant pseudopodia, stable and rarely interlaced. The majority live in fresh water, but some are marine. A common and widespread example is the genus *Actinophrys.*

HELIUM, a gaseous element, known to be present in the atmosphere and in certain minerals, and, like argon, characterized by chemical inertness. It is believed that helium is the final product of the disintegration of radium. It is also the ultimate product of the radioactivity of actinium and thorium. The discovery of helium was a consequence of the discovery of argon, and on account of the close chemical, physical and historical relations of the two, reference should be made to the article ARGON, and to the references there given. Helium was known to exist in the sun many years before it was discovered upon the earth. During a total eclipse of the sun, in 1868, Jannsen observed a brilliant yellow line in the spectrum of the solar chromosphere, very close to the D lines of sodium, and yet not identical with either of them. The new line was assumed to be due to a previously unknown element, and in the same year Lockyer proposed the name «helium» for this hypothetical element, from the Greek word «helios,» meaning the sun. No evidence of the existence of helium upon the earth was adduced until 1882, when an Italian scientist named Palmieri announced that he had obtained the spectrum of helium from certain of the lavas given off by Mount Vesuvius. He made no attempt to isolate the new body, however, and while it is quite possible that his observations were correct, he can hardly be credited with the actual discovery of helium. No further progress was made in this direction until 1895. When argon had been discovered, and its chemical inertness had been established, Mr. Miers, mineralogist of the British Museum, pointed out that the mineral cleveite had been shown to contain nitrogen gas, apparently in the free state, and made the suggestion that part of what had been assumed to be nitrogen might in reality prove to be argon. Professor William Ramsay examined the gas from this source, and found that while it undoubtedly did contain argon, it also showed a brilliant yellow line, which did not appear to coincide with either of the sodium lines, though it was very close to them. He sent a specimen of the gas to Sir William Crookes for a more careful examination, and Crookes promptly reported that the new line was identical with the helium line. It was therefore proved that helium, which had previously not been certainly known except as a constituent of the solar chromosphere, is also a terrestrial element. Subsequent study revealed the presence of helium in brögerite, urainite, fergusonite and several other minerals. It is given off from cleveite when that mineral is heated to about 400° F. in an exhausted tube, or when the mineral is treated with sulphuric acid, or with acid sulphate of potassium. By the heating process about half the helium content is secured; with the acid, all of it. All the minerals which contain any considerable quantities of helium also contain uranium, yttrium or thorium. It is not certainly known whether the helium is chemically combined with the mineral, or whether it is merely occluded by it. The latter supposition would appear to be the more probable, judging from the chemical inertness of the gas, and from the fact (presently to be noted) that radium appears to be generating helium continuously. Certain observations upon the mineral fergusonite, however, appear to give some color to the hypothesis that the helium is present in a state of chemical combination. As obtained from minerals helium usually contains 10 per cent of nitrogen and a smaller per cent of argon. Helium has also been found among the gases arising from the waters of certain hot springs, notably those of Maizieres, in which the proportion is 5.34 per cent. It occurs also in the natural gas of Kansas in the proportion of 1.84 per cent.

The presence of helium in the earth's atmosphere was established by means of subjecting the apparently pure argon that had been obtained from this source to a process of diffusion through a series of porous partitions of baked clay. Helium, being much lighter than argon, diffuses far more rapidly, and a mixture in which the two gases exist together may be partially separated into its constituents in this manner. The gas is present in the earth's atmosphere in the proportion of 1 volume of helium in 250,000 volumes of air.

Helium, when pure, has a density of only 1.98, that of oxygen being taken as 16. Its atomic weight cannot be directly determined, because helium has not yet been made to combine with any other substance, although it has been subjected to the same experimental attempts as were tried in the case of argon (q.v.). The only approach to this was in establishing the fact that zinc vaporized in helium has a vapor density 12 per cent greater than when vaporized in nitrogen under identical conditions. It has been found, however, that the ratio of the specific heat of the gas at constant pressure to the specific heat at constant volume is about 1.65, and this indicates that helium is a monatomic gas (see GASES, KINETIC THEORY OF), and that its atomic weight is about $2 \times 1.98 = 3.96$; the atomic weight of oxygen being taken as 16. It therefore has the smallest atomic weight of any of the known elements except hydrogen. The chemical symbol He has been assigned to helium, although, as has been already noted, no compounds of it have as yet been obtained.

Dewar thought he had liquefied helium at the temperature of melting hydrogen (about 436° F. below zero), but this was not confirmed by subsequent experiments. Success was finally achieved in 1909 by Onnes, using the Linde process. Liquid helium is colorless and very mobile. It has a density of 0.122, being therefore the lightest liquid known. It boils at 4.5° absolute. By evaporating it rapidly a temperature of —454° F. has been attained, but the helium did not solidify. Its critical temperature being nearer to the absolute zero than that of hydrogen, the gas is well adapted for use in thermometers intended for the measurement of exceedingly low temperatures. It has, in fact, been used for this purpose with success, in studying the properties of hydrogen.

A most remarkable and previously unparalleled fact in connection with helium remains to be recorded. It has been known for some time that helium occurs in cleveite, and in other minerals in which the newly discovered element radium is found; but whether this was to be regarded as a mere coincidence, or whether it has some actual physical and chemical significance, has been a subject of considerable discussion. The most striking experiment bearing upon this matter is one that is due to Huggins, who caused the radiation from radium to pass through a spectroscope provided with a quartz prism and to fall upon a sensitive photographic plate. Upon developing the plate after a prolonged exposure, he found that cold radium gives a line spectrum when treated in this manner; and he made the further discovery that nearly all of the lines in the spectrum so obtained are apparently coincident with lines in the spectrum of helium. The full significance of this fact is not yet known; but when taken in connection with the observations of Soddy and Ramsay, which indicate that helium occurs in the gaseous emanation that is given off by radium, it is considered by no means impossible that we have here an instance in which one element is being slowly but continuously transformed into another one. If this inference is corroborated by future experiments, it will throw an altogether new light upon the nature of the chemical elements, and upon their relation to one another. The case is the more noteworthy, since helium has a smaller atomic weight than any other element save hydrogen, and radium has a greater atomic weight than any other element save uranium and thorium. Radium, moreover, appears to be metallic in nature, while helium, by its chemical inertness, resembles nitrogen.

Helium is prepared by separating it from its mixture with nitrogen, argon, krypton, etc. Several methods are in use. If atmospheric nitrogen is passed over heated magnesium (with or without lime) the nitrogen is absorbed and the inert gases collected, to be afterward separated. Helium may also be obtained from liquid air by fractional distillation. The method most commonly used is to heat to redness the powder of helium-bearing minerals in a tube of iron or hard glass, having previously exhausted the air from the apparatus. The gases are collected over mercury. By this process one ounce of cleveite yields about two gallons of helium. The separation of helium from the mixed gases is accomplished by filtering through quartz. At a temperature of 1,850° to 2,200° F. quartz is permeable to helium. A tube of quartz is so arranged in an atmosphere of the mixed gases that it may be heated to the required degree, and at the same time the interior of this tube is exhausted by an air-pump. Under these conditions the helium passes through the quartz into the tube, from which it may be pumped into a collector. Or the gas mixture is passed into a vacuum tube containing charcoal at the temperature of liquid air. All the gases but neon and helium are condensed, and these are readily separated by the difference of their vapor pressures.

HELIX, hē'lĭks, a spiral, or a thing of spiral form; the advancing curved surface of a thread or a screw is the most familiar illustration. (1) In anatomy, a prominent and incurved margin surrounding the thinner and larger portion of the pinna in the ear. (2) In architecture, the small volute of a spiraled acanthus stalk under the abacus of a Corinthian column. Of these there are in every perfect capital 16: two at each angle and two meeting under the middle of each face of the abacus. Also the spiral of a staircase winding around a central post. (3) In geometry, a curve of a right line formed on a plane wrapped about a cylinder or a cone. The edge of the path of a screw is a helix, as is also the path described by any point of the surface of the thread when moved in the nut. (4) Any coil, as that of an electromagnet. (5) In zoology, the typical genus of the snail family. See SNAILS.

HELL as generally understood is the abode of evil spirits; the infernal regions, where the devil rules supreme, and whither lost or condemned souls go after death to suffer indescribable torments and eternal punishment either for wickedness inherited from the sin of Adam or for more or less serious infractions of the divine law. This region was usually thought of as being beneath the earth, in the darkness of vast underground caverns, or in the region of fire supposed — as seemed to be proved by volcanoes — to underlie the whole earth. The word is often used figuratively to describe any place or state of extreme wickedness, suffering or misery; as for instance, «The hells of vice,» «he (during illness) suffers the torments of hell,» «poverty is hell.» This article is concerned only with hell as a purely theological institution.

Hell, in the theological sense, has no place in most primitive religions, nor has heaven. The existence beyond death is almost universally thought of as «something between being and not being.» The Hebrew Sheol and the Greek Hades are good illustrations of this. There was no thought of dividing the future state into separate and distinct conditions of existence. Even so late a writer as the author of Ecclesiastes declares that «all (men and beasts) go unto one place» (Eccl. iii, 20) and «there is one event to the righteous and wicked» (Eccl. ix, 2). Much confusion and misunderstanding has been caused through the early translators of the Bible persistently rendering the Hebrew Sheol and the Greek Hades and Gehenna by the word hell. The simple transliteration of these words by the translators of the revised editions of the Bible has not sufficed to appreciably clear up this confusion and misconception. The popular idea of hell as a place of punishment — either redemptive or rigidly retributive in character — did not come suddenly and full-formed into existence. It is the product of centuries of thinking on the great problem of reward and punishment which, instinctively almost, man associates with human deeds. In the early stages the idea seems to have been that the souls of the dead appeared before the divine tribunal. The souls that could present a satisfactory record during their earth life were admitted to the presence and abode of the gods, and the souls that could not present such a satisfactory account were cast out not into a place of torment but into an existence more or less deplorable and wretched.

It is not necessary here to discuss the matter as it appears in the different religions of the world; for while there are many and significant variations of detail the main features of hell as conceived by Hindu, Persian, Egyptian, Grecian, Hebrew and Christian theologians are essentially the same. Several ideas enter into the creation of this place which has always loomed large in the Christian as well as other religions. One of the ideas or motives which led to the division of the future state into heaven and hell, a place of reward and a place of punishment, is hinted at in a few Old Testament passages. All the dead, without distinction, so it was believed, went down into Sheol. But according to Isaiah xiv the king of Babylon who had exiled and oppressed Israel, and is therefore accounted an enemy of Jehovah and his people shall «be brought down . . . to the *uttermost* parts of Sheol.» He was to be thrust into the deeper depths where presumably there was greater discomfort. Jehovah would send his enemies into a place much worse than those who served him. This idea wrought mightily in the lives of these people as it did in the lives of many later generations. These exiled and persecuted worshippers of Jehovah gathered consolation and a new endurance as they saw in the after life their enemies cast down into the bottom-most parts of Sheol while they would be in the upper and brighter and happier part. Other ideas and impulses entered into this. Instinctively almost a person feels that the ordering of life is such that a man shall reap what he sows — if he sows wickedness he shall reap all that is bad and hurtful. If he reaps not the painful consequences before he dies he will and must in the hereafter. And so there is a diversity of thought as to the purpose of hell in the «divine economy.» Some have thought of it as the place created by the Deity where He punishes with inconceivable severity, and through all eternity the souls of those who through unbelief or by the worship of false or different gods had angered Him. It is the place of divine revenge, untempered, never ending. This has been the idea most generally held among Christians, Catholic and Protestant alike. It is the idea embodied in the Mohammedan's conception. Slightly different from this is the conception of hell as the place where God punishes the soul of man not for unbelief, or failure to believe, or for believing in a wrong or different religion, but for some breach of the moral law. It was only natural that the religious leaders should seek to turn the unbeliever and the misbeliever from the error of his way and the evil-doer from his evil-doing by graphically picturing to them the terrible doom awaiting all who persist in following along wrong paths. The preaching of future punishment has given to the world a remarkable and extensive literature and has exerted a tremendous influence upon the life and thought of the people for many centuries.

From the first there has been a wide difference of opinion as to the extent and object of the punishment inflicted. Some have argued, basing their arguments on a certain understanding of a few Scriptural passages, and on certain theological theories, that the punishment of hell cannot be less than eternal in its duration. The satisfaction of Deity is the only legitimate object of this future punishment. An infinite being could not be satisfied with less. This, whatever the actual sense of the word Sheol as used by the biblical writers, does not appear to have been the view entertained by the early Christian churchmen — Clement, Origen and others. Although there have always been with the Church men of note who have taken issue with it, the *eternity* of hell's torments has been generally held and most ardently preached. But, at the present time the idea of punishing a soul eternally finds a decreasing number of believers. During the latter half of the 19th century the civil courts in England decided that a clergyman of the Established Church of England was under no sort of obligation to believe or teach the doctrine of eternal punishment. The Presbyterian Church during the early years of the present century was much disturbed by a great demand from its own people that the doctrine of the damnation of non-elect infants be eliminated from its confession and the demand was successful. All this is not a denial of future punishment but simply a disbelief in the eternal duration of that punishment. Naturally enough the men who protested against this punishment being eternal should argue that punishment in hell should be proportioned to the offense and that the object sought should be the redemption or reformation of the sinful soul. This idea stands out prominent in the Persian conception of hell, and the institution of purgatory seems clearly to be an attempt to modify the terrible severity of eternal punishment and square it somewhat with the sentiments of the human heart by providing a future punishment that should purge the soul of its remaining unfitness to enter heaven. Others press the point a little farther and argue that all future punishment must be of a reformative purpose. Hell thus becomes what might be called the final process in the divine plan of salvation. Still others there are who insist that eternal punishment is impossible. The souls that are purged in hell pass up to a higher sphere, those so confirmed in their wickedness that they grow worse there sink to lower levels until they virtually cease to be. This idea still has its advocates. Volumes have been written on the nature of the punishment inflicted. When it was generally believed that the earth was flat, fixed and at the centre of things, it was simple and inevitable to think of souls being tormented with the most frightful of physical tortures. With the definite establishing of modern astronomy «up to heaven» and «down to hell» became mere figures of speech, and the old idea of hell's torments necessarily underwent a corresponding change. The present understanding of the structure of the universe has enforced upon man a complete spiritual conception of things and so the idea now most generally held is that future punishment is essentially the remorse and misery within the soul. In the words of Milton:

> "Which way I fly is hell; myself am hell."

HELL GATE, a narrow part of the East River between Long Island and Manhattan and on the east and west sides of Ward's Island. The passage between Ward's and Randall's Island is called Little Hell Gate. It was called Helle Gat by the Dutch settlers of New York. The rocks which were in Hell Gate were of such form and so situated as to make navigation dangerous, and the difference in the times and heights of the two tides which enter East River increased the dangers. The East River receives at one extremity the Sound tide and at the other the tide from off Sandy Hook. "One sailing vessel out of every fifty" was the proportion damaged seriously when trying to pass through the channel between the reefs. Much had been said and written about the necessity of doing something to remove or at least lessen the dangers of Hell Gate, and officials of the United States navy, Lieutenants Davis and Porter, made a survey of Hell Gate in 1848. They reported the necessity of making the channel safe, and suggested the destruction of some of the most dangerous rocks, but nothing was done until the year 1851, when the work of destroying the rocks was begun. The process used was that of surface-blasting introduced by Maillefert. A portion of some of the rocks was removed, but this method of overcoming the dangers to navigation was found practically useless. In 1866 another survey was made by Brevet-Maj.-Gen. John Newton of the United States Engineer Corps, and in 1867 he submitted his report, in which he advised the removal of the reefs — the work to be done by blasting, and the drilling of the surface to be made from a fixed platform. Soon after the work of making Hell Gate safely navigable was resumed and placed in charge of John Newton. For the work Newton invented a steam-drilling cupola scow, which served as a transport and a working platform from which the drilling-engines were operated. The new machine proved satisfactory. A new system of explosion had to be devised in order to protect Ward's and Randall's islands and Astoria. Diamond, Coenties, and Ways reefs were removed, also Pilgrim Rock, before operations were begun on Hallett's Point Reef. The last mentioned was an obstacle to both large and small vessels. The excavations, begun in October 1869, were completed in June 1875. The drilling was completed 25 March 1876. The area operated upon was about three acres. The method of explosion was most successful. No damage was done to the windows or buildings near; it had no perceptible effect on the air, but little on the water, and the underground shock was slight, but was perceptible on Manhattan and the western part of Long Island. The removal of Flood Rock, which was in the middle of Hell Gate, made the navigable capacity of the channel more than double. The work of removing this most formidable obstruction was begun 7 June 1875. Lack of funds caused delay, and the explosion did not take place until 10 Oct. 1885. For the removal of Flood Rock about nine acres were tunneled and drilled; and the aggregate length of the tunnels was 21,670 feet, and of the drill holes, 113,102 feet. The object sought to be gained by removing the rocks and reefs was to make a channel of the uniform depth of 26 feet and of sufficient width for the largest steamers. Dredging which has since been in progress together with the rock removal by blasting now provide a channel 200 feet in width at the narrowest point and with a depth of 26 feet through Hell Gate. A railroad bridge, with a steel span of 977.5 feet supported on concrete bents was constructed across the East River at Hell Gate in 1914–15.

HELLAS, hĕl'ạs, the abode of the Hellenes, was first a town, and afterward, under the name of Phthiotis, a district in Thessaly. The ancients applied this name to the whole of Thessaly. With the spread of the Hellenic people the term embraced a gradually increasing territory, till it came to denote the whole of Middle Greece, and then the whole of Greece, with its islands and colonies. The Hellenes received this name in the belief that they were descended from Hellena, a mythical personage, a son of Deucalion and Pyrrha, or, according to others, of Zeus and Dorippe, and the father of Æolus, Dorus and Xuthus, was said to have been king of Phthia. See GREECE.

HELLBENDER, a large salamander (*Cryptobranchus alleghaniensis*) found chiefly in the streams emptying into the Great Lakes and those draining the western slope of the Appalachian Mountains. The hellbender is an ugly looking but perfectly harmless creature from 18 to 24 inches long; with the head and body much flattened and a prominent wrinkled fold of skin along the sides. Although entirely aquatic, no gills are present in the adult, and only a single pair of small pores represents the gill-clefts; the lungs are simple sacs. The limbs are functional, the anterior with four, the posterior with five digits, and the tail is provided with a wide fin. A wide mouth with teeth in both jaws, very small eyes and a slimy skin of a deep mottled brown color are further external characteristics. The giant salamander (*Megalobatrachus maximus*) of Japan is the only known closely related form. The hellbender is a sluggish animal, active chiefly at night, when its voracity causes great annoyance to fishermen whose bait and fish it devours. It is extremely tenacious of life and hibernates during cold weather. Although very common, its breeding habits are yet unknown.

HELLEBORE, a genus (*Helleborus*) of the crowfoot family (*Ranunculaceæ*), consisting of perennial erect herbs with scanty, palmately divided leathery leaves and yellowish, greenish or white terminal flowers. They are of interest on account of their poisonous and medical properties. About 10 species are natives of Europe and Asia, one of which (*H. viridis*) has become naturalized in the eastern United States. The Christmas rose (*H. niger*) is the source of the black hellebore of modern pharmacopœias, but the ancient black hellebore, a famous remedy for insanity, was probably obtained from other species. *H. viridis* and *H. fœtidus* have emetic and purgative properties. These plants are closely allied to the aconites.

White Hellebore is a very different plant, a species (*V. album*) of the genus *Veratrum* of the famly *Melanthaceæ,* which contains various other poisonous plants. They are profusely leaved, tall herbs growing in rich woods, and their roots contain the peculiar alkaloids veratroidin and jervin, to which their poisonous properties are mainly due. Eastern North America has a widespread species in the Indian poke (*V. viride*), which, like the European species, enters into the pharmacopœia, while its rootstocks are ground into the powder used as an insecticide. Several other species are natives of the western United States.

HELLENES, hĕl'ēnz, a native name for the ancient Greeks.

HELLENICS. Walter Savage Landor's collection entitled ‹Hellenics› consists of poems on Greek subjects, originally written, for the most part, in Latin. They were translated by Landor and published with additions in 1847. The pieces are properly idylls. in the sense used of the non-pastoral writings of Theocritus, and it is to these works of the Alexandrine school and to their Roman counterparts that Landor's poems bear the closest resemblance. Their classicism is invariably softened by a touch of sentiment and romance.

Some of the ‹Hellenics› are brief narratives or epyllia dealing with mythological or semi-mythological incidents; others are little dramatic scenes, portraying, for example, an encounter between Menelaus and Helen at the sack of Troy. Among the tales the loveliest is ‹The Hamadryad,› which tells of the unhappy love between a forest nymph and the mortal Rhaicos. But it is in the briefer pieces, such as ‹Iphigenia and Agamemnon,› which recounts the sacrifice of Agamemnon's daughter to Diana, and ‹Artemidora,› a classical deathbed scene, that Landor is supreme. The statuesque quality of these little poems places them among the highest examples of purely classic art in English. The charge of coldness often made against Landor does not apply here; for beneath the atmosphere of calm beauty there is a deep emotion made more poignant by the poet's conscious reticence. Brevity, purity of style and perfection of external form were Landor's ideals. There is little in his poems to catch the popular ear — no striking phrases, for example, or highly-colored pictures; but for lovers of the classics and to readers of taste and judgment they will always have a strong appeal. Consult ‹Works.› edited by C. G. Crump, 1891–93; essays by DeQuincey, Saintsbury, DeVere; see bibliography in Cambridge, ‹History of English Literature› (Vol. XII).

James H. Hanford.

HELLENISTS, a name given the Jewish colonists who settled in Egypt after the destruction of the kingdom of Judah, about 600 B.C. Their number was increased by the many colonies of Jews planted by Alexander the Great (336 B.C.), and later by Ptolemy Lagus. Under the reign of the Emperor Augustus they numbered to nearly 1,000,000. They laid the foundation of a new epoch of Græco-Jewish literature, which, from its prevailing character, received the name of the Hellenistic. The Alexandrian Jews were the most influential in developing Hellenizing tendencies, and to them chiefly is to be referred the formation of the peculiar dialect termed the Hellenistic. In their literature the systems of Pythagoras and Plato were strangely combined with those Oriental fantasies which had been reduced to a system in Egypt, and with which the mystical doctrines of the Gnostics were imbued. The most noted Jewish Hellenistic philosopher was Philo of Alexandria, and the chief of the learned labors of the Alexandrian Jews was the Greek translation of the Old Testament.

HELLESPONT, hĕl'ĕs-pŏnt. See Dardanelles.

HELLGRAMMITE, hĕl'gră-mīt, the large black aquatic larva of the insect Corydalus (q.v.), much used as bait for black bass and other game fish. It lives in streams, preying upon smaller animals, and just before pupation crawls under large stones, where it can be found at about the same time as the bass are biting. It is also called «Dobson» after a maker of artificial baits. See Dobson.

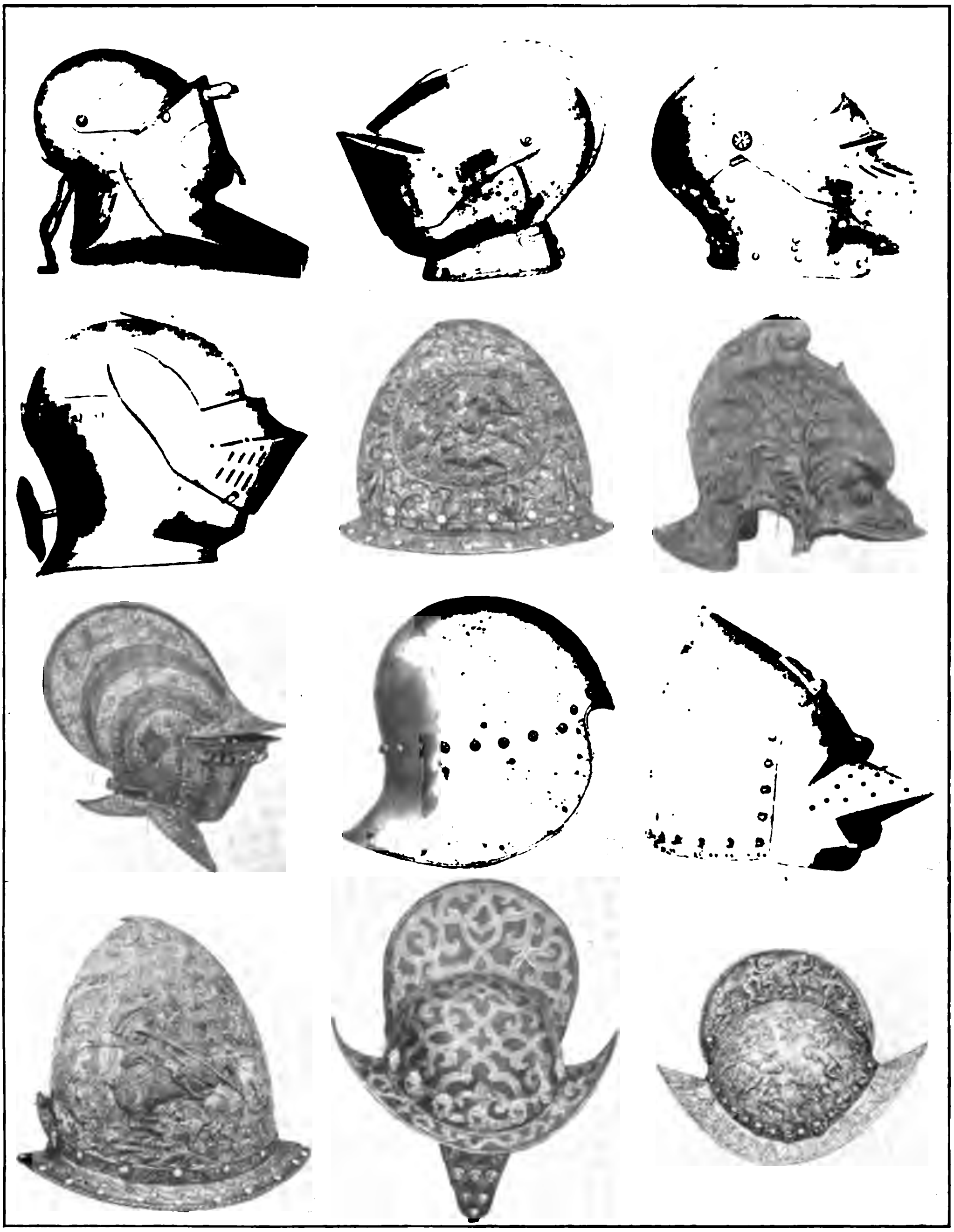
HELM, Israel, Swedish colonist in America: b. 1615; d. 1695. He settled on the Delaware River, in 1649; was collector of customs at Philadelphia 1659, and became a member of Captain Carr's council 1668. He was chief interpreter between the colonists and Indians. and rendered valuable service at the meeting of the New Jersey Indians, Governor Andros and the Swedish authorities, in 1675.

HELMET-SHELL, a large gasteropod of the genus *Cassis,* family *Cassidæ.* Most of the species inhabit tropical shores, but a few are found on the coast of the Mediterranean. The shells of *C. rufa, C. cornuta* and *C. tuberosa* (the queen conch), are the material on which shell cameos are usually sculptured.

HELMETS AND HELMS. Armor for protection of the head. Often the term casque, the French equivalent, is used synonymously for helmet. The fully developed helmet consists of a skull-piece called «timbre» or «bowl» (a domed piece of metal beaten into a shape closely fitting the back and top of the head); the «crest» (a projection extending from the forehead to the nape of the neck, similar to a cock's comb); a «visor» (protecting the forehead and eyes) containing a slit or *cleft,* called the «ocularium,» in front to allow vision; a «ventail,» below the visor, protected the features and had, usually, perforations to admit air; a chin-piece, called «bevor» or «mentonière»; and, lastly, the neckguard, called either «colletin,» «gorget» or «gorgerin.» In the rear was often a tube or other device for holding the knightly plumes.

Helmets date back, at least, to the ancient Egyptians and Assyrians, when they were made of strong fabric or leather, then metal. The oldest metal helmets extant are Assyrian (8th century B.C.). Homer's heroes wore elaborate bronze helmets with flowing horsehair bushes, chin-straps and plates protecting the neck, ears and cheeks; later the Greeks adopted an immovable visor with ocularium. These helmets had crests of great height and fantastic forms. The ancient Roman helmets, originally of leather (*cudo*), were soon replaced by bronze (*cassis*) during the republic. The «galea» (Minerva's classic helmet), first of leather,

HELMETS



1 Tilting Casque. German (16th Century)
2 Tilting Helmet. French (16th Century)
3 Italian Helmet (1510)
4 Italian Armet à Rondelle (1475–1500)
5 Cabasset. Italian (1550)
6 Burganet. Italian (1525)
7 Burganet. French (1550)
8 Salade-Barbute. Italian (15th Century)
9 "Pig-face" Basinet. German (1400)
10 Morion-Cabasset. Italian (1555–56)
11 Morion. German (1556)
12 Morion. Dutch (late 16th Century)

was later made of bronze and encompassed the entire head, cheeks as well, leaving orbicular eye openings and a nasal projection in the centre of the opening. From about 600 A.D. to about 1000 A.D. the «Spangenhelm,» a conical or «sugar-loaf» headpiece was in vogue. It was made of leather and reinforced with triangular plates rivetted at the lower extremity to a metal ring, the apex of each piece meeting at top in a button. The Norman helmet in William the Conqueror's time (1066) was of conical shape and had a nasal projection. Cheek pieces and neck defenses were next added to the nasal helmet. A cylindrical, or «barrel» shaped, flat-topped «great helm» or «heaume» (heavy headpiece) came into use in the 12th century, quickly followed by the «round topped» near the close of the century. The great helm was worn over the «coif-de-mailles» (see CHAIN ARMOR), and was followed by the «sugar loaf» helm with conical form and with «camail» attached. The cup-shaped «cervellière» or «basinet» was worn under the helm or by itself; and the «wide-brimmed» iron hat (*Eisenhut*) was worn from now on all through the period of metal armor, in spasmodic intervals. (This is the helmet worn in this century's World War as defense against shrapnel). The sugar-loaf helmet next took on a «beaked» movable visor pivoted at the sides, after the middle of the 14th century. Middle of the 15th century arrives the «salade» with its rear extension protecting the neck. Growing longer in front, with a horizontal «cleft» for sight, a movable visor is next attached before the end of the century. Another variety was known as the «Venetian» salade; its low neck part was extended round the sides, protecting the ears and cheeks. They were termed «barbutes» as they developed, by the end of the century, into the ancient *galea* form with oval eye apertures and nasal piece. In the 15th century the great jousting helm was in use; it was very heavy and large, with somewhat flat crown, and was fastened to the body armor by screws. To this century belong the wide-brimmed hat-shaped «chapels-de-fer.» Also in this century developed the greatly admired, perfect head-piece — the «armet.» Earliest of these is the «armet à rondelle»; it consists of the «calotte» (skull-piece), or «timbre,» which is shaped to the head and prolonged to the nape of the neck; a «visor» protecting the face is movable on side pivots; the «bevor,» covering the chin; the «gorgerin» composed of several plates of steel binding the armet to the corselet (see PLATE ARMOR); a «rondelle» or disc, mounted in the nape of the neck, like a mushroom, to the shaft of which was attached a scarf called «volet» (hinged plate). Later armets («close helmets») avoided the defect of the open contact of the neck-plate (*gorgerin*) with the body armor by giving the lower edge of the gorgerin a half-round (*bead*) projection which overlapped and fitted in a shallow rim in the upper edge of the body armor, thus closing up the joint and allowing the casque to rotate on the corselet. Crests soon appeared in this very fight, closely fitting helmet — the armet. The armet was in use through the reign of Henri IV and even under Louis XIII (17th century). Later improvements in the armet were fluting the «timbre» to strengthen it and thereby allowing reduction in thickness and weight. Next, the visor has two parts (upper and lower) both working on the same pivot; crests come next together with betterment of the *gorgerin*. Out of the armet arose another casque form termed «burgonet» (spelled also *burganet, burgonette,* etc.); an «umbril,» or «umbrere,» was added fixedly to the visor to protect the eyes. It was shaped and acted just like the modern peak of a cap. In some of the early burgonets was an easily detachable chin protection called «buffe,» instead of the umbril. A lighter form of burgonet has flaps at the sides to protect the ears, and is free from either visor, umbril or buffe; but the lower part projects rear and front to protect face and neck; ear plates are at the sides. Another development was the extension of the neck protection by overlapping plates; this is the «lobster-tail» burgonet of Cromwell's Ironsides. In the last evolution of the burgonet the laminar neck-piece is raised to nearly horizontal, or is displaced by a horizontal plate; a nasal rod is on some and can be raised or lowered at will. The lobster-tail and later burgonets belong to the 17th century. A 16th century casque was the «morion» of Hispano-Moresque origin, with grotesque high crest ridge and uptilted peaks front and rear; these developed into the «cabasset,» becoming more and more pot-shaped. The morion and cabassets were head defenses of the pikemen, and in the 17th century became the «pikeman's pot» and «iron hat» or «kettle hat.» Armor decadence, with advance in fire-arms efficiency, brought about the last remnants of head defenses in the form of metallic «hatlinings» (first solid plate, then perforated, lastly a wattle of metal strips), and the so-called «spider-helmet,» in which the strips continue below the cap with spider-like appearance and so jointed as to be conveniently folded together into the smallest space.

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CLEMENT W. COUMBE.

HELMHOLTZ, hĕlm'hōlts, **Hermann Ludwig Ferdinand von,** German scientist: b. Potsdam, 31 Aug. 1821; d. Charlottenburg, 8 Sept. 1894. He studied medicine in Berlin, and received the appointment of assistant surgeon in the Charité Hospital there in 1842. Next year he went to Potsdam as a military surgeon, but in 1848 he returned to Berlin to assume the duties of teacher of anatomy at the Academy of Art and assistant in the Anatomical Museum. He was called to the chair of physiology at Königsberg in 1849, and six years later went to Bonn as professor of anatomy and physiology. In 1858 he was appointed professor of physiology at Heidelberg, whence he returned in 1871 to Berlin as professor of physics. In 1888 he was appointed to the post of president of the new Physikalisch-Technische Reichsanstalt (Imperial Physico-Technical Institute) in Charlottenburg. Helmholtz was distinguished alike in physical science, in mathematics and in physiology; but his most valuable and most original work was done in those departments of physics which stand in intimate relations with physiology, especially acoustics and optics. In 1851 he invented the opthalmoscope, a most useful device and now in universal use. He developed the electromagnetic theory of light and indicated its possibilities. He invented new apparatus in practical physics. He had an eminently philosophical mind, and his works are no less valuable for their masterly exposition of the methods of experimental science than for the important results contained in them. His scientific fame was securely established as early as 1847, when he published 'Über die Erhaltung der Kraft' (On the Conservation of Energy). This subject was pursued further in 'Über die Wechselwirkungen der Naturkräfte' (On the Interactions of Natural Forces) (1854). His greatest works are the 'Handbuch der Physiologischen Optik' (Handbook of Physiological Optics) (1856–66); and 'Die Lehre von den Tonempfindungen' (1862; 5th ed., 1896), translated into English by Ellis under the title 'Sensations of Tone as a Physiological Basis for the Theory of Music' (1875). A collection of 'Vorträge und Reden' reached a fourth edition in 1896, and has been translated into English as 'Popular Lectures on Scientific Subjects' (1873–81). An edition of his scientific treatises was published at Leipzig in three volumes (1882–95), and in 1897 his 'Lectures on Theoretical Physics' appeared in one volume. In his 'Beschreibung eines Augenspiegels' (1851) he described the ophthalmoscope he had recently invented. In 1883 he was ennobled by the German emperor. He visited the United States in 1893, when he was selected an honorary president of the International Congress of Electricians at the Columbian Exposition, Chicago. He contributed papers to the principal scientific Journals of the world. Consult Hall, G. S., 'Founders of Modern Psychology' (New York 1912); Königsberger, 'Hermann von Helmholtz' (Leipzig 1902; Eng. trans., Oxford 1906); McKendrick, 'H. L. F. von Helmholtz' (London 1899); Rücker, A. W. 'Hermann von Helmholtz' in *Fortnightly Review* (November 1894); and reprinted in the *Smithsonian Report* of the same year.

HELMONT, Jan Baptista van, Flemish physcian and chemist: b. Brussels, 1577; d. near Brussels, 30 Dec. 1644. He devoted his attention to scientific research, and although he put forth some visionary theories on the constitution of man, and on diseases, made some genuine discoveries in chemistry. He was probably the first to introduce the term "gas" into science, and was the earliest observer of the acid reaction of the gastric juice. He published 'Ortus Medicinæ' (1648); and 'Opuscula Medica Inaudita' (1644), works which still possess interest for students.

HELMUTH, William Tod, American physician: b. Philadelphia, 30 Oct. 1833; d. New York, 15 May 1902; graduated Homeopathic Medical College, Philadelphia, 1853; Hahnemann College, San Francisco, 1866. In 1877 he became professor of surgery and dean of the New York Homeopathic College and Hospital. He was an officer in numerous medical associations and a member of the Société Medicale Homeopathique of France. Among his published works are 'Treatise on Diphtheria'; 'Medical Pomposity'; 'System of Surgery'; 'Scratches of a Surgeon'; 'Suprapubic Lithotomy'; and some volumes of poetry.

HELODERMA, hĕ-lō-dĕr'mạ. See GILA MONSTER.

HELOÏSE, ā-lō-ēz, or **ELOISE.** See ABELARD.

HELOTS, hē-lŏts, were the lowest of the four classes into which the population of ancient Sparta was divided. They are generally supposed to have been the aboriginal population of the country, and to have been reduced to bondage by their Dorian conquerors, their numbers being swelled from time to time by the addition of peoples conquered in war. The name is generally derived from the town of Helos, the inhabitants of which were carried off and reduced to slavery by the Heraclidæ about 1000 B.C., though a more probable derivation is the Greek *helein*, to take, making the name signify captives. They were the property of the state, which alone had the disposal of their life and freedom. The state assigned them to certain citizens, by whom they were employed in private labors, though not exclusively, as the state still exacted certain services from them; and they were attached to the soil — that is, each citizen received the number that belonged to his allotment, without any power to sell or free them. Agriculture and all mechanical arts at Sparta were in the hands of the Helots, since the laws of Lycurgus prohibited the Spartans from all lucrative occupations. But the Helots were also obliged to bear arms for the state, in case of necessity. Their dress, by which they were contemptuously distinguished from the free Spartans, consisted of sheep's skin and a leather cap of a peculiar shape. They were sometimes liberated for their services or for a sum of money; but they were not admitted to the full dignity of citizenship. In 424 B.C. 2,000 of the Helots, who had conducted themselves with distinguished bravery in war, were treacherously put to death. They several times rose against their masters, but were always and finally reduced.

HELPER, Hinton Rowen, American author: b. near Mocksville, N. C., 27 Dec. 1829; d. Washington, D. C., 9 March 1909. He published in 1857 'The Impending Crisis of the South,' which the Republican party used as a campaign document with great effect against the continuance of slavery. Later works by him are 'The Three Americas' Railway' (1881); 'Nojoque' (1867); 'The Negroes in Negroland' (1868); 'The Land of Gold' (1865).

HELPS, SIR Arthur, English essayist and historian: b. Streatham, 10 July 1813; d. London, 7 March 1875. He was educated at Eton and Cambridge; became private secretary to Lord Monteagle as Chancellor of the Exchequer, and

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was afterward commissioner of French, Danish and Spanish claims. In 1860 he was appointed clerk of the privy council, and held this post till his death. He was created K.C.B. in 1872. As an essayist he was one of the most popular writers of his day, and his historical works had an extended reputation. He possessed very wide and general culture and sound judgment, was painstaking and accurate in details, and in his historical works displayed considerable breadth of view. His principal works are 'Thoughts in the Cloister and the Crowd' (1835); 'Essays Written in the Intervals of Business' (1841); 'Friends in Council' (1847–57); 'Conquerors of the New World' (1848–52); 'Companions of My Solitude' (1851); 'Spanish Conquest of America' (1855–61); 'Oulita the Serf, a Tragedy' (1858); 'Realmah' (1869); 'Casimir Maremma' (1870); 'Brevia, Short Essays and Aphorisms' (1870); 'Life of Hernando Cortes and Conquest of Mexico'; 'Thoughts upon Government' (1871); 'Social Pressure' (1874).

HELSINGFORS, hĕl'sĭng-fŏrs, Russia, seaport town, capital of Finland, on a small peninsula in the Gulf of Finland, 180 miles by rail west-northwest of Petrograd. It is defended by the fortress of Sveaborg about three miles distant, and is the residence of the governor of Finland, the seat of important courts and public offices. The most noteworthy buildings are the governor's residence, senate house, university buildings, the Russian church, the church of Saint Nicholas (Lutheran), the Athenæum and two modern theatres. Its university, removed from Abo in 1827, has a library of over 190,000 volumes. There are four faculties and about 2,500 students; maintains a hospital, zoological and botanical museums, botanic gardens and an observatory. The town is a popular bathing place, has very many newspapers, of which 40 are in Finnish and about 30 in Swedish. There are manufactories of linen, sail-cloth, tobacco, beer, sugar, liquors, linen, carpets, etc., and an important trade is carried on in agricultural and dairy products with English, German, Russian and Swedish ports. It is the seat of a United States consul. It was founded in 1550 by Gustavus I of Sweden on a site further inland, removed to its present site in 1640 and was destroyed by the Russians in 1713. It was fortified in 1729 and came into the possession of Russia in 1809. It was bombarded by the allied fleet for 48 hours during the Crimean War. Consult Brummer, 'Historiska anteckningar om Helsingfors och Sveaborg' (Helsingfors 1874); Ehrström, 'Helsingfors stads historia från 1640 till Stora Ofrenden' (ib. 1890); id., 'Finland in seclet' (ib. 1893); Hertzberg, 'Helsingfors för tre hundra år sedan och i våra dagar' (ib. 1888); Nordham, P., 'Bidrag till Helsingfors stads historia' (ib. 1905–08): and 'Finlandias vyserie' (Vol. I, ib. 1906).

HELVETIAN REPUBLIC, the designation of the republic established in Switzerland by France in 1798. See SWITZERLAND.

HELVETIC CONFESSION, the name of a document drawn up by Martin Bucer in 1536 to settle the controversy between the Lutherans and the Zwinglians; and also of one drawn up by Bullinger (1566) at the request of Friedrich III, Elector of the Palatinate, and adopted in Switzerland, the Palatinate, France, Hungary, Poland and Scotland.

HELVETII, hĕl-vē'shĭ-ī, a former Gallic or Celtic nation, settled between the Rhone and the Rhine, the Jura and the Rhætian Alps. They were more numerous and warlike than the neighboring Gallic tribes. They first appear in history 107 B.C., but were not known to the Romans until the time of Julius Cæsar, who, as governor of Gaul, prevented their intended emigration, and after many bloody battles, in which even the Helvetian women fought, pressed them back within their frontiers. The story of their meditated irruption into and seizure of southern Gaul is circumstantially related in the First Book of the Commentaries of the Roman general, who not only repulsed them with terrible slaughter, but almost exterminated them. Not a third of those who left their homes on this ill-fated expedition ever returned. Helvetia, which was less extensive than the present Switzerland, was divided into four districts, which had an entirely democratical constitution. Cæsar subjected the country to the dominion of the Romans, who established several colonies there. After the death of Nero, the Helvetii, for refusing to acknowledge Vitellius as emperor, were mercilessly punished by Cæcina, one of his generals, and thenceforth they almost disappear as a people.

HELVÉTIUS, ĕl-vā-sē-ŭs, **Claude Adrien**, French metaphysician: b. Paris, January 1715; d. there, 26 Dec. 1771. At the age of 23 he obtained a lucrative post of farmer-general, where he was distinguished by his mildness and indulgence from his colleagues, whose base practises filled him with indignation. He therefore resigned his office, and purchased the place of *maître d'hôtel* to the queen. Aspiring after literary fame, he first directed his efforts to mathematics, then attempted to rival the dramatic fame of Voltaire by writing a tragedy. In 1758 he published 'De l'esprit,' the materialism of which drew upon him many attacks. It was condemned by the doctors of the Sorbonne, and publicly burned in accordance with a decree of the Parliament of Paris. Helvétius went in 1764 to England, and the year afterward to Germany, where Frederick the Great and other German princes received him with many proofs of esteem. A complete edition of his writings was published at Paris in 1795. Consult Morley, 'Diderot and the Encyclopedists' (1878).

HEMANS, Felicia Dorothea Browne, English poet: b. Liverpool, 25 Sept. 1793; d. near Dublin, Ireland, 16 May 1835. She displayed the bent of her genius when a mere child, and wrote some tolerable poetry in her ninth year. She first appeared as an author, in 1808, in a volume entitled 'Early Blossoms,' but it was subjected to harsh criticism, which she took very seriously to heart. A second volume, published in 1812, 'The Domestic Affections,' was much more successful. The same year she married Captain Hemans, from whom she was separated in 1818. She then resumed her literary pursuits, made herself acquainted with Latin and modern languages and wrote much in the periodicals of the time. At the suggestion of Reginald Heber, afterward bishop of Calcutta, she wrote a tragedy entitled 'The Vespers of Palermo,' which, owing partly to Sir Walter Scott, who wrote an epilogue for it, was favorably received at the Edinburgh theatre, though it had previously, in 1823, proved unsuccessful at Covent Garden. Before this time she had added greatly to her popularity by her poems entitled 'The Restoration of the Works of Art to Italy'; 'The Skeptic'; 'Modern Greece'; and 'Dartmoor.' Later works were 'Lays of Many Lands'; 'Forest Sanctuary'; 'Records of Woman'; and 'The Songs of the Affections' (1830). She visited Sir Walter Scott at Abbotsford, and Wordsworth at Rydal Mount, and left with each the impression of a singularly graceful and gifted woman. Her poetry is essentially lyrical and descriptive, and is always sweet, natural and pleasing. In her earlier pieces she was imitative, but she ultimately asserted her independence, and produced many short poems of great beauty and pathos. Mrs. Hemans had no dramatic power, her effusions being always intensely subjective. A memoir was published in 1836.

HEMATIN, or HÆMATIN. See Hæmoglobin.

HEMATITE, native sesquioxide of iron, Fe_2O_3, a mineral widely distributed, and constituting a valuable ore of iron. It crystallizes in the rhombohedral system, and also occurs in massive form, sometimes forming beds of great thickness. It has a hardness of from 5.5 to 6.5, and a specific gravity ranging from 4.9 to 5.3. It is usually dark gray or black in color, the earthy varieties being red. It has a metallic lustre, and is sometimes slightly magnetic, occasionally even showing magnetic polarity. Hematite occurs in the rocks of every age. The extensive masses that occur in metamorphic rocks are believed to have been deposited, originally, in marshes, undergoing metamorphosis at the same time as the rocks with which they are now associated. By many it is believed that the great beds in the Lake Superior region were laid down in the sea as iron carbonate or silicate, and later weathered to hematite, after the region became land. Fibrous and columnar forms of the mineral, brownish-red or black in color, are also known, and to these the name «red hematite» is sometimes applied. In crystalline and metamorphic rocks a variety known as «specular iron» is met with, which is distinguished by the presence of crystals having a splendid lustre. Hematite occurs in vast quantities in various parts of the United States, notably in upper Michigan, in the Marquette district, and in the Menominee and Gogebic ranges, in northern Wisconsin; and in Saint Louis County, Minn., in the famous Mesapi Range. Iron Mountain, Missouri, is a hill about 200 feet high, the surface of which consists of loose blocks of hematite, many of which weigh as much as 10 or 20 tons. In 1914, hematite yielded 91 per cent of the iron ore produced in the United States. The name «hematite» is from a Greek word signifying «blood,» and was given to the mineral by the ancients from its fancied resemblance to coagulated blood. Hematite is sometimes called «bloodstone» at the present time, though that name is more properly applied to a green variety of quartz, which contains small spots of red jasper. An allied mineral, consisting of hydrated sesquioxide of iron and known to mineralogists as limonite, is often popularly called «brown hematite.» See Iron Ores.

HEMATURIA, hem-ą-tū'rĭ-ą, the presence of blood in the urine, which points to disease of the kidney or bladder. It is a symptom of some gravity. The treatment of the cause will probably remove this affection; in all cases complete rest is very important. See Trematoda.

HEMIANÆSTHESIA, hĕm-ĭ-ăn-ĕs-thē'-si-ĭ, loss of sensation on one half of the body, right or left.

HEMIPLEGIA, hĕm-ĭ-plē'jĭ-ą (lit. «half a stroke,» that is, of paralysis), paralysis of one side of the body. It is usually caused by hæmorrhage in the brain cavity, commonly known as apoplexy; often a local accumulation of serum, or a tumor is the cause. The paralysis falls on the side of the body opposite to the lesion in the pyramids of the brain, unless the lesion occurs below the decussation of brain fibres. The treatment of hemiplegia requires the services of a physician. It is amenable to timely remedies, and a cure is generally obtained after the first attack, if it result from apoplexy; but the patient is liable to subsequent attacks.

HEMIPODE. See Button-quail.

HEMIPTERA, hē-mĭp'tē-rą, an order of insects. It contains two leading groups, the *Homoptera* and *Heteroptera*. In the former the two pairs of wings when present are applied in rest pent-house fashion to the sides of the body. Several families are wingless. Cicadas, plant-lice (*Aphis*) and the like come here. In the second group the wings, when at rest, placed horizontally across the body, the second pair covered by the upper, which are *hemielytra*, that is, the basal half is leathery, the distal portion membranous. See Bug.

HEMLOCK POISON, one of various plants. (1) A highly poisonous umbelliferous herb of the genus *Conium*, one species of which is European and the other African. The well-known officinal European one (*C. maculatum*) has become extensively naturalized as a weed in the United States. It is easily recognized by the wavy, crenate ridges of its short, laterally compressed fruit, and also by the disagreeable mouse-like odor when bruised (see Conium). (2) The water hemlocks or cowbanes of the closely allied genus *Cicuta*, which is both European and American. The common American species is *C. maculata*, which grows in swamps and wet places, and is also dangerously poisonous, especially in its turnip-like cavernous root. See Cicuta.

HEMLOCK, coniferous trees of the genus *Tsuga* of which two species are recognized, the common northern one (*T. canadensis*), and a more local one of the southern Alleghanies (*T. caroliniana*). The wood is too soft, weak and brittle to be of extensive use as lumber, but the bark is of great importance in tanning. See Fir.

HEMMETER, John Cohnheim, American physician, physiologist and musical author: b. Baltimore, Md., 25 April 1863. He received his early education in the public schools of Baltimore, and was graduated at Baltimore City

College. Later he studied at the Royal Gymnasium, Wiesbaden, where he remained six years. Returning to Baltimore he took his degree of doctor of medicine at the University of Maryland, then entered the Johns Hopkins University, where the degree of doctor of philosophy was conferred on him in 1893. He holds the degree of doctor of science honoris causa from the University of Maryland and of doctor of laws from Saint John's College, Annapolis. Has been consultant to many hospitals in the city of Baltimore. Holds the position of professor of physiology and clinical professor of medicine and director of the physiologic laboratory of the University of Maryland. He is one of the editors of the *Archives for Digestive Diseases* published in Berlin; also associate editor of the *International Contributions to Diseases of Digestion and Metabolism,* edited by Prof. Adolf Bickel of Berlin. Dr. Hemmeter is the author of the first complete work in the English language on diseases of the stomach. His work, 'Diseases of the Intestines' (2 vols., 1901) is even up to the present time the only complete work on this subject in the English language. He has published 120 various researches and investigations in American and foreign medical and scientific journals. He is at present engaged in editing a 'History of Medicine,' a large part of which has already been published in the form of separate journal articles. Two medical advancements of the greatest importance for which Dr. Hemmeter is well known are his discovery that the X-rays could be used for studying abnormal conditions of the digestive tract (Boston *Medical and Surgical Journal,* June 1896), and that it was possible not only to investigate the stomach contents directly by the introduction of tubes, but also to pass tubes into the upper part of the small intestine, called the duodenum. This latter led to a method of treating gastric ulcers and other conditions of the stomach requiring absolute rest of the organ by introducing a duodenal tube through the stomach into the upper part of the intestine and injecting the food directly into the intestine, skipping the stomach, as it were. It was found that conditions defying all other treatment healed when the stomach was thus absolutely put to rest. Dr. Hemmeter is also a musical author and has published a cantata for male chorus and full orchestra, entitled 'Hygeia.' One of his most recent works is a 'Manual of Physiology' (1912). Being a physiologist as well as a musician, Dr. Hemmeter was singularly fitted to investigate the physiologic and anatomic foundations of piano technique and of vocal tone production. He studied the neuro-muscular co-ordinations necessary in piano technique; also the effect of music on blood pressure and the central conducting paths for tone sensations, the object being to place piano technique, as well as vocal tone production, on a physiologic basis. He is a Fellow of the American Association for the Advancement of Science; member of the Physiologic Society of Germany; one of the presidents at the last International Congress for Physiology held at Groningen, Holland, 1913; member of the German Congress for Internal Medicine; member of the Imperial German Academy of Natural Sciences; Kaiserlin, Carolin, Leopoldin, Akademieder Naturforscherl; member of the Imperial Association of Austrian Physicians, Vienna; Fellow of the Royal Society of Arts, England, and member of the Accademie di Scienze, Italy.

HEMOGLOBIN, an organic coloring matter, which constitutes about nine-tenths of the weight of dried red blood corpuscles, and serves as a carrier of oxygen from the lungs to the general tissues of the body. It is an exceedingly complex substance, and its formula is not certainly known. It is a chromoprotein and has an interesting history. Iron is found throughout nature and early became incorporate within living matter as an energy transformer. In order to transform energy, oxygen chiefly and yet not by itself, oxidizes and is thus destroyed, a peculiar substance being formed which in plants seems to develop with the proteid of chlorophyll and in animals into what is called hemoglobin. In the lowest worms and mollusks this iron compound is known. In these low forms it is found as a part of the muscle substance itself. When the blood scheme arose in higher animals it then entered into that fluid as an oxygen carrier. The complex uses to which it is put lie outside of this article. Zinoffsky gives it as $C_{712}H_{1130}N_{214}S_2FeO_{245}$; but this can hardly be regarded as more than a guess. According to many authorities, hemoglobin is not a definite chemical compound, but a more or less variable mixture of simple substances. It gives all the general reactions of the proteids, but, unlike most of the proteids, it may easily be obtained in crystalline form, its crystals commonly occurring in rhombic plates or prisms, varying somewhat in shape, according to the source from which the substance is prepared. The exceeding physiological importance of hemoglobin depends upon the fact that it readily combines with oxygen to form a very unstable compound known as oxyhemoglobin. The combination takes place as the blood corpuscles containing the hemoglobin pass through the lungs; and the loosely-combined oxygen is given off again as the corpuscles pass through the capillaries, the oxyhemoglobin being thereby again reduced to hemoglobin. Hemoglobin also combines with carbon monoxide to form a similar but far more stable substance known as carboxyhemoglobin. In poisoning by the inhalation of coal-gas the carbon monoxide present in the coal-gas combines with the hemoglobin in the lungs, and the carboxyhemoglobin so formed does not break up again. As the absorption of the coal-gas proceeds, a continually increasing quantity of hemoglobin is therefore destroyed, so far as its utility as an oxygen-carrier is concerned. In extreme cases of such poisoning, transfusion of blood is resorted to, in order that the patient may have a sufficient supply of hemoglobin to transport the requisite quantity of oxygen from the lungs to the other tissues of the body.

Crystals of hemoglobin have been prepared. Pure hemoglobin has a purplish color, which gradually passes into a scarlet or a yellowish red, as the substance absorbs oxygen and becomes thereby converted into oxyhemoglobin. Carboxyhemoglobin is even more brilliantly red than oxyhemoglobin. All three of these substances exhibit marked absorption spectra when in solution, and very small quantities of them can be easily detected by the spectroscope. It is said that the presence of one part of hemoglobin in 10,000 parts of water can be distinctly demonstrated by this means.

When oxyhemoglobin is acted upon by acids or alkalis, or by the gastric juice, it is resolved into a proteid substance and a definite compound which has the probable formula $C_{68}H_{70}N_8Fe_2O_{10}$ and is known as hematin. Hematin may be best prepared by extracting blood clot, directly, with hot alcohol to which a small quantity of sulphuric acid has been added. The extract is next agitated with chloroform, which takes up the hematin. The chloroform is then separated, washed with water to remove the acid, and allowed to evaporate, when the hematin is deposited in the form of a bluish-black powder. Hematin is a very stable compound, and may be heated to 350° F. without decomposition. At higher temperatures it burns with evolution of hydrocyanic acid, leaving an ash composed chiefly of oxide of iron. It is insoluble in water, ether, dilute acids and pure alcohol; but it dissolves readily in solutions of the caustic alkalies, and in alcohol to which a small quantity of sulphuric acid has been added. Consult Stirling, 'Physiology'; Bayliss, 'General Physiology'; Matthews, 'Physiological Chemistry.'

HEMOPHILIA, a congenital inherited disease characterized by a tendency to obstinate bleedings. Women are very rarely affected, but transmission of the disease seems to be from the father through the daughters to the grandsons, and from father to son. The disease usually makes itself evident in early life, a slight wound being followed by abundant and uncontrollable hemorrhage, whereby the child becomes known as a "bleeder." Besides the liability to excessive hemorrhage, these subjects are frequently afflicted with trouble in the joints, probably a chronic inflammation, the result of repeated small hemorrhages. Death is always imminent, as the flow of blood tends to continue and is particularly dangerous where large areas of the body are injured. The causes are not completely understood. In some bleeders a calcium deficit is found in the body. This is supposed to influence the nature of the blood-vessel wall permitting a transudation of blood. Various salts of calcium are therefore utilized.

HEMOPTYSIS, expelling blood from the lungs, larynx or bronchial tubes by coughing. It may be a symptom of phthisis, but bleeding from the lungs or trachea may result from a number of different disturbances. Profuse bleeding is apt to be phthisical.

HEMORRHAGE. See BLEEDING.

HEMORRHOIDS (Greek, *haima*, blood, and *rheo*, to flow), literally, a flow of blood. Until the time of Hippocrates this word was used, conformably to its etymology, as synonymous with hemorrhage. It was afterward used in a narrower sense, to indicate the flux of blood at the extremity of the rectum, and in some other cases which were considered analogous to it; thus it was applied to the flow of blood from the nostrils, the mouth, the bladder and the uterus. It is at present used to signify a particular affection of the rectum, although the disease is not always attended with a flux; in this sense the affection is also called piles. Certain general causes may produce a predisposition to this disease; in some cases, it appears to be the effect of a hereditary disposition; in general, it manifests itself between the period of puberty and old age, although infants and aged people are not entirely exempt from its attacks. Men are oftener affected than women, in whom it is sometimes produced by local causes. It often shows itself in subjects who pass suddenly from an active to a sedentary life, or from leanness to corpulency. Any circumstance which produces a tendency to pressure on the venous return of blood in the pelvis is to be reckoned as a local cause. The accumulation of fecal matter in the intestines as in habitual constipation; efforts to expel urine; the pressure produced by polypi; the obstruction of any of the viscera, especially of the liver; worms; use of drastic purges, particularly of aloes; long continuance in a sitting posture; riding on horseback; pregnancy; the accumulation of water by ascites;— such are some of the ordinary causes of hemorrhoids.

Several varieties of hemorrhoids are distinguished. They are known as external when apparent at the anus; internal when concealed within the orifice; blind or open, regular or irregular, active or passive, periodical or anomalous, etc. There is also a great difference in the quantity of blood discharged; it is usually inconsiderable, but in some cases is so great as to threaten the life of the subject. The quality, color, etc., of the blood, also differ in different cases. The number, seat and form of the hemorrhoidal tumors likewise present a great variety of appearances. When the disease is purely local it is cured more readily; but in the greatest number of cases it is connected with some other affection, or with the constitution of the subject. In these cases, if the piles are not troublesome on account of their size or if the bleeding is not very considerable, cure of the primary affection should be attempted. The best mode of treatment is then to recur to hygienic rather than medicinal influences. The subject should avoid violent exercises, but moderate exercise will be found beneficial. The standing position is to be avoided as much as possible, especially following defecation. The constipation (q.v.) with which the subjects of this disease are liable to be affected should be remedied by hygienic dieting. If the pain is considerable, recourse should be had to sedatives and local application of hot water. If the disease appears under a more severe form, more violent remedies will become necessary. If the discharge of blood becomes excessive, particular care must be taken to regulate it. If the tumors acquire a considerable volume, surgical operations are necessary. At the present time the operative treatment of persistent hemorrhoids is both safe and efficacious.

HEMP. The hemp plant proper, or "common hemp," is *Cannabis sativa*, an annual plant belonging to the family *Urticaceæ*. The term hemp, however, is used to designate many other kinds of fibre which are in no way related to the common hemp, such as Manila hemp, from a plantain, sisal hemp from an agave, bow string hemp, from a liliaceous plant, and 30 or more other kinds. The different kinds of common hemps are also specially designated, with prefixes, as Breton hemp, Piedmontese, Russian, English, China and Japanese hemps and many others, some of these being trade names, or the names of varieties. The hemp plant proper is a native of that part of Asia which includes China, India and Persia, though, like flax, its culture has been extended to many portions of the world in both temperate and tropical climes. It was used by the Scythians 2,500 years ago, and it was probably known to the Chinese and Europeans many centuries earlier. The Romans used it for sails and cordage, but not until after the dawn of the Christian era. It grows wild in many parts of China and India, where it is regarded as much for its drug product known as chang or hasheesh as for its fibre. It flourishes on both the east and west coasts of Africa, and has been naturalized in Australia, as well as in several South American countries. In Europe it is cultivated chiefly in France, Italy, Germany and central and southern Russia, and it will grow in Great Britain and Sweden. The plains of Hungary are peculiarly adapted to its culture. It is a favorite textile in China and Japan, the fibre from the last-named country being particularly strong and fine, and at the same time better prepared than many European hemps. The plant is an annual, the fibre being produced in the bark of the straight stiff stalks or stems, and is therefore a bast fibre. In the experiments of Roxburgh and others, Russian hemp is taken as the standard of comparison for all other fibres. The stems vary from 3 to 20 feet in height, dependent upon the variety and the soil in which grown. The best kinds have a hollow stem, the wood of which breaks down readily when cleaned for the fibre. While hemp is produced commercially in very few localities of the United States, it will thrive from ocean to ocean and from the Gulf to Canada. Its cultivation as a fibre crop is confined chiefly to Kentucky, Ohio, Indiana, Wisconsin and California, though considerable hemp, in past time, has been produced in New York, and to some extent in Tennessee, Illinois, Nebraska and Minnesota. Lately it has been experimented with in the South, notably in Mississippi and Texas. The bulk of the crop is grown at the present time in Kentucky and California. The 1914 crop was the smallest on record; said to be due to changes in the tariff and in part to the fact that the tobacco crop pays better.

The Kentucky hemp industry is very old, for the fibre was cultivated in the early part of the last century. The annual production, in 1859, reached a total of 75,000 tons, but 20 years later it had fallen off to such an extent that 5,000 tons only were recorded for the entire country. Since that time it has fluctuated between 5,000 and 12,000 tons as the total crop of the country, the annual production in 1914 being but 2,000 tons. In that year the total acreage in the United States devoted to hemp growing was about 5,000 acres. Of this Kentucky had 2,500 acres; Indiana, 1,000 acres; California, 600 acres; Ohio, 500 acres; Wisconsin, 350 acres. The average acre-yields varied from 1,200 pounds of fibre in California to 600 pounds in Kentucky, and the farm price ranged from four and a half cents to eight cents. In Japan the annual crop is about 10,000 tons, all used in domestic industries; and Japan also imports 15,000 tons annually from India and China. Among the world's hemp producers Russia ranks first and China second.

In its own sphere of usefulness no substitute for hemp has been found satisfactory. American hemp was at one time used to some extent for the rigging of vessels, although its largest use was for bagging. As early as 1824 it was employed in the navy, and efforts were made later by the government toward the production of better grades of hemp by water-retting. The fibre has also been used for twines and for woven fabrics. In late years the demand has been largely for a low grade fibre that could be manufactured into binder twine, but for this purpose it has not been found satisfactory, and the bulk of the binder twine is made from manila and sisal. Very recently there has been a demand for a better grade of fibre, which has resulted in more careful methods, particularly on the Pacific coast, where a fibre has been produced fit for fine twines and cordage. Kentucky and Illinois hemps are coarse, dark in color and are not carefully prepared, which is the reason for the low price of 3½ to 6 cents against 8 and 12 cents per pound for finer imported hemps. The best hemp comes from Italy, chiefly from the provinces of Bologna and Ferrara, the fibre being very white, very well prepared and of superior strength. Breton hemp from France is almost as good, but rarely imported. Russian comes in several grades, some light, but not as light as the Italian, some dark like the native fibre and low in grade. Some good hemp comes from Austria-Hungary, and a trifle from other portions of Europe. Little if any of the Japan fibre reaches this market, though the best Japanese is as good as the Italian. We consume annually less than 10,000 tons, including both the native and imported.

There are many varieties of the hemp plant, four or five having been grown in the United States, though it is said that the bulk of the seed at present sown is the China hemp and a Japanese variety. In California, Japan hemp has yielded 7,000 pounds to the acre at a total cost of $67, and a value of eight cents per pound. Five varieties are cultivated in Europe, a common form reaching a height of five to seven feet; Piedmontese or Bologna, an Italian variety that averages 12 feet in height; China hemp, introduced in 1846; a small hemp found in the valley of the Arno and around Tuscany; and Arabian hemp, cultivated for the resinous principle or drug.

Limestone soils, clayey loams and the alluvial soils of the river bottoms are best adapted to hemp culture, and the seed bed should be almost as carefully prepared as for flax. Generous fertilizing both with stable manure and chemical fertilizers is well repaid in quality as well as quantity of crop. One to three bushels of seed are sown per acre broadcast and highly covered. The planting, in Kentucky, usually begins in April, and the crop may be harvested in 100 days. The most approved practice is to allow the hemp to lie on the ground, turning it over at intervals, till the leaves drop from the stalks. It is then gathered into stacks and water-retted during the following winter. Upwards of 300 machines for breaking hemp have been patented, but the Shely Hemp Gin seems to be the only one which has met with popular favor. It requires a crew of 15 men and turns out 1,000 of clean, straight fibre per working hour. For further particulars regarding the culture and preparation of this fibre, see Special Reports Nos. 1, 8 and 11, office of Fibre Investigations of the Department of Agriculture, and Hemp Culture in the United States, Year-books of Agriculture for 1911 and 1913. See also the ‘Dictionary of the Economic Products of India.’

While some 300 patents have been issued in this country for hemp machines, the bulk of the fibre is extracted by means of the old-fashioned, clumsy wooden «slat-breaks» that has been employed from time immemorial and without improvement or change. With one of these breaks a Kentucky negro can extract perhaps 150 pounds of fibre in a day. The breaks used in European hemp countries are little better, though they are smaller and less clumsy. The best foreign hemps are water-retted, the stalks dried with great care, often in kilns, and therefore are more evenly prepared and the fibre soft, strong and light in color — almost white as in the Italian and French hemp. On the contrary most of the American hemps are dew-retted, and are exposed to alternate freezing and thawing, as the stalks lie on the ground, giving an inferior product, uneven and very dark in color, often a slate gray. Those water-retted bring double the price of the dew-retted. See Cordage; Cordage Industries; Fibre; Flax; Manila Hemp; Ramie; Sisal.

Consult United States Plant Industry Bureau Bulletins 46 and 221; and Moore, B., ‘A Study of the Past, the Present and the Possibilities of the Hemp Industry in Kentucky’ (Lexington, Ky., 1905); United States Foreign and Domestic Commerce Bureau's Special Agents' Series No. 74, ‘Linen, Jute and Hemp Industries.’

Chas. Richard Dodge.

HEMP-AGRIMONY. See Eupatorium.

HEMP-NETTLE, a genus (*Galeopsis*) of European plants of the mint family, two species of which have become naturalized as weeds in the eastern United States.

HEMPHILL, James Calvin, American journalist: b. Due West, Abbeville County, S. C., 18 May 1850. He was graduated at Erskine College in his native town in 1870 and entered journalism as editor of the Abbeville (S. C.) *Medium* in 1871. In 1880 he joined the staff of the Charleston *News and Courier*, of which from 1888 to 1910 he was manager and editor. In 1911 he became editor of the Charlotte (N. C.) *Observer;* joined the editorial staff of the New York *Times* in 1912, and later became Washington correspondent of the Philadelphia *Public Ledger*. He was Bromley lecturer on journalism at Yale in 1909–10, and first vice-president of the Associated Press in 1909.

HEMPL, George, American philologist: b. Whitewater, Wis., 6 June 1859. He was graduated at the universities of Michigan in 1879 and of Jena in 1889, and was appointed instructor in German at Johns Hopkins University in 1884. After spending three years abroad (1886–89) in study at Göttingen, Tübingen, Strassburg and Berlin, he became junior professor of English in the University of Michigan, where he has been professor of English philology and general linguistics since 1897. He has been a voluminous writer, and among his technical works may be mentioned ‘German Orthography and Phonology’ (1897); ‘German Grammar’ (1901). He was president of the American Philological Association in 1903–04, and assisted in the pronunciations of Pierce's ‘French Dictionary.’

HEMPSTEAD, N. Y., village, in the town of the same name, in Nassau County, on the Long Island Railroad, about 15 miles east of the borough of Brooklyn, and 10 miles from the ocean. The village was settled in 1643 by people from New England. The Presbyterian Society of Hempstead claim the oldest Presbyterian organization in the country, dating their beginning in this village in 1644. The Episcopal church owns a communion service presented by Queen Anne. Hempstead is located in a section of Long Island in which there are many summer homes of New Yorkers. It has a public library and two parks, and is the seat of Turner Institute. During the war with Spain an encampment for State troops was located at Hempstead; it was called Camp Black after the then governor of the State. The chief industrial interests are market gardening, farming and the manufacturing of cork insoles, phosphates and carriages. The waterworks are municipally owned. Consult Onderdonk, ‘The Annals of Hempstead, 1643–1832’ (Hempstead 1878). Pop. 4,946.

HEMPSTEAD, Tex., town, county-seat of Waller County, on the Houston and Texas Central Railroad, about 50 miles northwest of Houston and 113 miles east by south of Austin. It is situated in a fertile agricultural region, noted for its cotton fields and its vegetable products. It has cottonseed-oil mills, cotton-gins, pickle factories, and its trade is chiefly in cotton, grain, fruits and vegetables. Pop. 1,978.

HEMS, or **HOMS**, hōms (Lat. *Emesa*), Syria, an ancient city, near the Orontes and the Lake of Homs, 86 miles northeast of Damascus and having railway connections with the coast. Its temple of the sun-god Elagabalus was famous, and one of its priests became emperor of Rome, assuming its title, in 218. Here in 272 Zenobia was defeated by Aurelian, and in 1832 the forces of the sultan of Turkey by Ibrahim Pasha. The town is still surrounded by its ancient walls, now in a ruinous condition, and has the largest and strongest citadel in Syria. It has some manufactures of silk goods and gold ornaments, and a trade in oil and agricultural produce. Pop. 60,000.

HEMSTREET, Charles, American journalist and author: b. New York, 20 Sept. 1866. He entered the profession of journalism as a reporter in 1886, and was connected with the City Press Association until 1900, when he resigned to devote himself to literature and historical research. He has published 'Manhattan' (1888); 'Nooks and Corners of Old New York' (1899); 'The Calendar of Old New York' (1900); 'History of New York City' (1901); 'When Old New York was Young' (1901); 'Nooks and Corners of Old London' (1910).

HEN-HAWK, or CHICKEN-HAWK, any kind of hawk which attacks poultry, or is supposed to do so. Two or three large buzzard-hawks are popularly so called in the eastern United States, and at least two smaller falcons. In the West, and in other parts of the English-speaking world, are other species of the same repute, more or less well deserved. In England the analogue of the American marsh-hawk (q.v.) is known as "hen-harrier." Certain owls everywhere kill much poultry where it is not safely housed at night. In North America the best known hen-hawks are the broad-winged, red-tailed and red-shouldered. (See BUZZARD). They are comparatively harmless to poultry, however, feeding mainly on squirrels, mice, frogs, etc. The broad-wing (*Buteo pennsylvanicus*) is one of the most familiar of our hawks, breeding numerously in the woods all over the country. It is 16 inches long, with a tail 7 inches, and the wing 11 inches. The upper parts are dull umber-brown, the tail almost black, crossed by two to four pale brown bands; the lower parts are dull rufous brown, nearly unbroken on the breast. It is rather sluggish in temperament, though capable of swift and bold action, and feeds mainly on mice, but will now and then seize young chickens, ducklings, etc. On the whole, as in the case of the other buzzard-hawks, it is of more service than injury to the agriculturist. The real culprits are two small, swift, agile falcons, Cooper's (*Accipiter cooperi*), and the sharp-shin (*A. velox*). The former is nearly two feet long, grayish-brown on the upper parts and white below, with the sides and breast barred with dusky red-brown and tail barred with blackish. The sharp-shin has much the same colors, but is little more than half as large, and is further distinguished by the triangular shape of the tarsus, giving it an edge in front. These bold and active falcons live mainly on birds, and on farms prey largely on chickens and house-sparrows, compensating somewhat for the former by killing the latter. Consult Fisher, 'Hawks and Owls of the United States' (Washington 1893).

HENBANE, a dangerous plant (*Hyoscyamus niger*) of the family *Solanaceæ,* which contains the tobacco, stramonium and other plants abounding in narcotic poisons. The black henbane (*H. niger*) is a species of the Mediterranean region, and springs up in waste places throughout Great Britain and rarely in the eastern United States, where it has become naturalized. It is an annual, somewhat bushy, about two feet high, with large sinuate or sharply lobed, sessile leaves and large dingy yellow flowers with purplish veins. The whole plant is covered with unctuous hairs and has a nauseous smell. The seeds contain in largest quantity the specific alkaloid hyoscyamin, which crystallizes in stellate acicular crystals of a silky lustre. The symptoms of poisoning by henbane are similar to those produced by other narcotic poisons, and the proper treatment is the same as in cases of poisoning by opium. In medicine henbane is employed both externally and internally. The leaves are the part commonly used; they are gathered and quickly dried when the plant is in full flower. Fomentations of henbane are applied to painful glandular swellings, parts affected with neuralgia, etc., and are often found to afford relief. An extract of henbane is sometimes employed instead of belladonna to dilate the pupil of the eye. Tincture and extract of henbane are often administered in cases of annoying cough, spasmodic asthma and other diseases requiring sedatives and anti-spasmodics. For many cases it has one great advantage over laudanum, in not producing constipation. The other species of henbane possess similar properties. The dried stalks of *H. albus* are used by smoking in Greece to allay toothache.

HENDERSON, Charles Belknap, American public official: b. San José, Cal., 8 June 1873. He studied at the University of the Pacific in 1892 and took a special course in history at Stanford University. In 1895 he was graduated at the law school of the University of Michigan and in the following year established his practice at Elko, Nev. For over 10 years he has served as regent of the University of Nevada. He was appointed member of the United States Senate by Gov. Emmet D. Boyle, on 4 Jan. 1918, to fill the vacancy caused by the death of Francis G. Newlands. In the Spanish-American War he served as second lieutenant in the 2d United States Volunteer Cavalry.

HENDERSON, Charles Hanford, American educator and author: b. Philadelphia, 30 Dec. 1861. He was graduated from the University of Pennsylvania in 1882; was lecturer at the Franklin Institute 1883–85, 1885–86; Ph.D. at Zürich in 1892; lecturer on education at Harvard 1897–98; and director Pratt Institute, Brooklyn, 1898–99. He founded Marienfeld Summer Camp for Boys and was its headmaster for 17 years, and was headmaster of the Marienfeld Open-Air School at Lamascand, N. C., 1914–16. Now engaged in writing and research work. He has published 'Elements of Physics' (1900); 'Education and the Larger Life' (1902); 'John Percyfield' (1903); 'The Children of Good Fortune' (1905); 'The Lighted Lamp' (1908); 'Pay-Day' (1910); 'What is it to be Educated?' (1914).

HENDERSON, Charles Richmond, American sociologist: b. Covington, Ind., 17 Dec. 1848; d. Charleston, S. C., 29 March 1915. He was graduated at the University of Chicago in 1870 and at Union Theological Seminary in 1873. From 1873 to 1883 he was pastor at Terre Haute, Ind., and from 1883 to 1892 at Detroit. In 1892 he was appointed assistant professor of sociology at Chicago University, and was afterward advanced to the full professorship. In 1898–99 he was president of the National Conference of Charities, in 1902 president of the National Prison Association and in 1910 of the International Prison Congress. In 1907 he served as secretary of the Illinois Commission on Occupational Diseases. He published ‘The Development of Doctrine in the Epistles’ (1894); ‘The Social Spirit in America’ (1896); ‘Introduction to the Study of Dependent, Defective and Delinquent Classes’ (1893–1901); ‘Social Settlements’ (1897); ‘Social Elements’ (1898); and edited ‘Abridgment of and Introduction to Edition of Thomas Chalmers’ The Christian and Civic Economy of Large Towns’ (1900); ‘Modern Prison Systems’ (1903); ‘Modern Methods of Charity’ (1904); ‘Die Arbeiterversicherung in den Vereinigten Staaten von Nord Amerika’ (1907); ‘Industrial Insurance in the United States’ (1907); ‘Social Duties from a Christian Point of View’ (1909); ‘Education in Relation to Sex’ (1909); ‘Social Programmes of the West’ (1913).

HENDERSON, David Bremner, American statesman: b. Old Deer, Scotland, 14 March 1840; d. Dubuque, Iowa, 25 Jan. 1906. He was educated in the public schools and Upper Iowa University; in 1861 entered the army as lieutenant of the 12th Iowa regiment; lost a leg at Corinth (1863), and was discharged from the service. He then became commissioner of the board of enrolment in the 3d Iowa district, but re-entered the army as colonel in 1864. He studied law and was admitted to the bar in Iowa in 1865, and was United States district attorney in the northern division of Iowa 1869–71. He early became prominent in the local politics of his district, and was a delegate to three Republican national conventions. In 1882 he was elected to the House of Representatives, and was re-elected biennally till 1902. He was for many years one of the leaders of the Republicans in the House, served on the Committee of Appropriations for 10 years and was chairman of the Judiciary Committee and a member of the Committee on Rules in the 54th and 55th Congresses. He assisted Speaker Reed (q.v.) in the making of the «Reed rules,» was consistently an advocate of sound money and a strong supporter of President McKinley's Cuban policy. At the organization of the 56th Congress in 1899 he was chosen speaker of the House, and re-elected in 1901; he was an impartial presiding officer and took important part in shaping the legislation made necessary by the Spanish War and the acquisition of new territory. In 1902 he declined a unanimous renomination from his district, because he could not support the policy of tariff revision then made a prominent issue by Iowa Republicans.

HENDERSON, James Pinckney, American soldier and politician: b. Lincoln County, N. C., 21 March 1808; d. Washington, D. C., 4 June 1858. He practised law in Mississippi; went to Texas in 1836, and became secretary of state of the Texan Republic 1837–39. In the latter year he was sent as a Minister to England and France to secure the recognition of Texan independence, and went to Washington in 1844 to secure annexation. He was a member of the Texas Constitutional Convention 1845, and the following year was elected first governor of the State. In 1857 he was appointed senator from Texas as a State Rights Democrat. Henderson fought in the Mexican War and Congress gave him a sword for his gallantry.

HENDERSON, Peter, American horticulturist: b. Porthead, Scotland, 1823; d. Jersey City, N. J., 17 Jan. 1890. He came to America in 1843 and opened a seed-store in New York city in 1862. He has been called «the father of horticulture and ornamental gardening in the United States.» He published ‘Practical Floriculture’ (1867); ‘Gardening for Profit’ (1866); ‘Gardening for Pleasure’ (1875); ‘Garden and Farm Topics’ (1884); ‘How the Farm Pays’ (1884).

HENDERSON, Richard, American pioneer: b. Hanover County, Va., 1734; d. North Carolina, 1785. He studied law and in 1769 was appointed associate justice of the Superior Court of North Carolina. After the adoption of the Declaration of Independence he declined reelection to the bench, in order to participate in the scheme of the Transylvania Land Company. By this scheme the company organized as a political community with president, legislature and judges, all the territory lying between the Cumberland River, the Cumberland Mountains and the Kentucky River. The State of Virginia annulled the deed of sale of this tract of territory which the Cherokee Indians had given to the Transylvania Land Company, but as a reward for the pioneer work of the company, granted them an area 12 miles square on the Ohio River, below the mouth of the Greene River.

HENDERSON, William James, American musical critic and author: b. Newark, N. J., 4 Dec. 1855. He was graduated from Princeton College in 1876, and joined the staff of the New York *Tribune*. Joined the staff of the New York *Times* January 1883. Became music critic of that paper 1887. Since September 1902, has been music critic of the New York *Sun*. He was associate editor of ‘The Standard Dictionary’ (1892–94). He was lecturer on «History of Music» at New York College of Music, 1889–1903, and on «History of Vocal Art,» Institute of Musical Art, since 1905. He is a member of National Institute of Arts and Letters, and member of the National Institute of Social Sciences. He served in naval militia of New York as ensign and afterward lieutenant from 1891 to 1902. Wrote libretto of ‘Cyrano,’ opera by Walter Damrosch. He has published ‘The Story of Music’ (1889); ‘Preludes and Studies’ (1891); ‘Sea Yarns for Boys’ (1894); ‘Afloat with the Flag’ (1895); ‘Elements of Navigation’ (1895); ‘The Last Cruise of the Mohawk’ (1897); ‘What is Good Music’ (1898); ‘How Music Developed’ (1899); ‘The Orchestra and Orchestral Music’ (1899); ‘Richard Wagner’ (1901); ‘Pipes and Timbrels’ (1905); ‘Modern Musical Drift’ (1906); ‘The Art of the Singer’ (1904); ‘Some Forerunners of Italian Opera’ (1911); ‘The Soul of a Tenor’ (1912).

HENDERSON, Ky., city, county-seat of Henderson County, on the Ohio River, here spanned by a magnificent bridge, and on the Illinois Central, the Louisville and Nashville, the Louisville, Henderson and Saint Louis railroads, about 10 miles below Evansville, Ind., and 103 miles, in direct line, southwest of Louisville. It has regular steamboat connection with Louisville, Evansville, Memphis and other river ports. It is one of the oldest settlements on the Ohio River, but it was not incorporated until 1797. It is situated in a fertile agricultural region, rich in timber and coal. The chief manufactures are cotton and woolen goods, flour, hominy, lumber, box factories, tobacco products, furniture, carriages and wagons, foundry products, car-works and agricultural implements. Large shipments are made of corn, wheat, fruit and tobacco. It has large coal and lumber yards, grain-elevators, tobacco-stemmeries, fine fairgrounds and Atkinson Park, the area of which is about 100 acres. It has a sanatorium, a Carnegie library and a number of well-built churches and schools. The charter of 1893 provides for a mayor, who holds office four years and is not eligible for re-election, and a common council. The city owns and operates the electric-light and gas plants and the waterworks. Audubon and Edgewood, two adjoining towns, were annexed in 1905. Pop. 12,192.

HENDERSON, N. C., town, county-seat of Vance County, on the Southern and the Seaboard Air Line railroads, about 12 miles east of Oxford and 42 miles north of Raleigh. Henderson was settled in 1820, but was not incorporated until 1842. It is situated in a cotton and tobacco region of the State. The chief industrial establishments are cotton-gins, cottonseed-oil mills, cotton-mills, knitting-mills, tobacco warehouses, wagon-factories, flour-mills, bagging-mills, buggy and automobile factories and lumber-yards. Its chief trade is in cotton and tobacco. It is governed by a mayor, elected for two years, and a town council. Pop. 4,503.

HENDERSON, Tex., town, county-seat of Rusk County, on a branch of the International and Great Northern Railroad, about 122 miles southeast of Dallas and 165 miles north by east from Houston. It is situated in an agricultural section, and the chief industries are connected with agricultural products. Its chief industrial establishments are a foundry, a pottery, sawmill, creamery and cotton-gins. The trade is in manufactured articles, live-stock, cotton and vegetables. It is the seat of a normal college. Pop. 4,500.

HENDERSONVILLE, N. C., town, county-seat of Henderson County, on the Southern Railway, about 21 miles south of Asheville and 100 miles west of Charlotte. It is situated in a mountainous portion of the State, but in the valleys are fertile farm lands. The chief industrial establishments are a furniture factory, a tannery, a canning factory, creamery, hosiery mills and a lumber yard. Apples and vegetables are among the agricultural products shipped to other markets. Hendersonville has a large number of summer guests owing to the healthfulness of the climate and the beauty of the scenery. It is the seat of the Blue Ridge School for Boys, and contains a Carnegie library and hospital. The waterworks are the property of the city. Hendersonville is under the commission form of government. Pop. 2,818.

HENDRICK, Thomas Augustine, American Roman Catholic bishop: b. Penn Yan, N. Y., 29 Oct. 1849. He was educated at Saint John's College, Fordham; Seton Hall College, South Orange, N. J., and Saint Joseph's Seminary, Troy, N. Y. He was ordained to the priesthood in 1873 and became successively assistant at Saint Mary's, Rochester, N. Y. (1873–74); rector of Holy Cross Church, Charlotte, N. Y. (1874–77); rector of the church at Union Springs, N. Y. (1877–91); rector at Aurora and Cayuga, N. Y. (1891–95); rector of Saint Bridget's, Rochester (1895–1903). In 1903 he was consecrated bishop of Cebú, P. I. He reorganized his diocese and succeeded in putting an end to the Aglipay schism which was rampant there. He has taken part in numerous congresses of American charitable associations and in 1904 was a delegate of the United Charities of America to the World's Congress of Charitable Associations, London. He also served as vice-president of the Society for the Prevention of Cruelty to Children and from 1900 to 1904 was regent of the University of the State of New York. He is a frequent contributor of articles on charity and charity organization to newspapers and periodicals.

HENDRICKS, Thomas Andrews, American politician, 21st Vice-President of the United States: b. near Zanesville, Ohio, 7 Sept. 1819; d. Indianapolis, Ind., 25 Nov. 1885. He was graduated at South Hanover College, Indiana, in 1841; studied law and was admitted to the Indiana bar in 1843. In 1845 he was elected to the legislature, and in 1850 and 1852 to Congress. In 1860 he was the Democratic candidate for governor of Indiana, but was defeated. He was a United States senator 1863–69; and at the Democratic National Convention of 1868 received 132 votes for the Presidential nomination. In the same year he was again defeated for the governorship of Indiana, but in 1872 was elected. In the Democratic National Convention of 1876 he was nominated for the Vice-Presidency, but the ticket, headed by Tilden, was defeated. Hendricks was again nominated for the Vice-Presidency in 1884, however, on the ticket with Cleveland, and on this occasion was elected.

HENDRIE, Sir John Strathearn, Canadian statesman: b. Hamilton, Ontario, 15 Aug. 1857. He was educated at Hamilton Grammar School and Upper Canada College. He entered the provincial legislature of Ontario in 1902, was minister without portfolio 1905–13, and in the latter year was appointed lieutenant-governor of the province. He was created K.C.M.G. in 1915.

HENDRIX, Eugene Russell, American Methodist bishop: b. Fayette, Mo., 17 May 1847. He was graduated from Wesleyan University, Middletown, Conn., 1867; and the Union Theological Seminary 1869. Appointed bishop of the Methodist Episcopal Church South, in 1886, he has since made official visits to China, Japan, Korea, Mexico and Brazil. He is the possessor of John Wesley's manuscript 'Journal' written in America 1736–37. He has written 'Around the World' (1878); 'Skilled Labor for the Master' (1900); 'Christ's Table Talk' (1908).

HENGIST, hĕng′gĭst, Saxon founder of the kingdom of Kent in Great Britain: d. about 488. He and his brother Horsa were renowned among the Saxons for their bodily strength and the antiquity of their family, which derived its origin in a direct line from Odin. In 449 the Britons sued for aid from the Saxons against the inroads of the Scots and Picts. Under command of Hengist and Horsa the Saxons landed at the mouth of the Thames, attacked the enemies of the Britons and defeated them near Stamford in 450 A.D. As soon as they had received reinforcements from home they sought occasion for a quarrel, and uniting with the Scots and Picts they attacked the Britons, who were forced to flee or submit to the Saxons. Some fled to Armorica (Haute-Bretagne), to which they gave their name. Hengist, who had lost his brother in the battle near Eglesford (now Aylesford) in 455 A.D., founded the kingdom of Kent. He established his residence in Canterbury. By some of our writers Hengist and Horsa are regarded as mythical personages. Consult Bede, 'History Eccl.' (1896); Nennius, 'Historia Brittonum' (1844).

HENING'S STATUTES, the first complete collection of the laws of any American State, including those of its colonial times, those repealed and those dropped in revision. These were the "Statutes at Large of Virginia, 1619–1792," in 13 volumes, published at Richmond 1809–23, by William Waller Hening, clerk of the Court of Chancery; Jefferson is said to have suggested the publication. It is highly valued as a historical source.

HENLEY, William Ernest, English poet, critic and journalist: b. Gloucester, 23 Aug. 1849; d. Woking, 12 July 1903. He entered on a journalistic career in London, and in 1877 became first editor of the magazine *London*. He was then editor successively of the *Magazine of Art* (1882–86), of the *Scots* — later the *National Observer* — (1888–93), and of the *New Review* (1893–98). His first publication, 'In Hospital: Rhymes and Rhythms' (1888), was inspired by his own experiences as a patient in Edinburgh Infirmary. Its contents were subsequently included in 'A Book of Verses' (1888). A second volume of poems, 'The Song of the Sword,' appeared in 1892 (2d ed., as 'London Voluntaries,' 1893). Both of these books were incorporated in the collection of his 'Poems' (1898). Later poetical works were 'For England's Sake' (1900); and 'Hawthorn and Lavender and Other Verses' (1901). Henley collaborated with Stevenson four plays, 'Deacon Brodie,' 'Beau Austin' and 'Admiral Guinea' and 'Macaire.' He also edited, either alone or in co-operation with others, the following anthologies and collections: 'Lyra Heroica' (1891), an anthology of English patriotic verse; 'A London Garland: from Five Centuries of English Verse' (1895); 'Book of English Prose' (1896); 'English Lyrics, 1340–1809' (1897); 'The Works of Lord Byron' (1897); 'The Poetry of Wilfrid Blunt' (1896); and 'London Types' (1898), and was editor of a series of 'Tudor Translations.' The 'Centenary Burns' (1896–97) is an important work edited by him with the co-operation of T. F. Henderson. The fourth volume contains an elaborate estimate by Henley of Burns as poet and man, published separately in 1898. His critical work appears at its best in 'Views and Reviews: Literature' (1890), and 'Views and Reviews: Painting and Sculpture' (1901). Both as poet and critic he was prejudiced and aggressive, but keen, vigorous and often distinguished in style. A paper on Stevenson contributed to the *Pall Mall* in 1901 aroused much unfavorable comment by its arraignment of Balfour's 'Life.'

HENLEY-ON-THAMES, England, a historical market-town and municipal borough of Oxfordshire, on the Thames, 35 miles by rail west of London. The town is especially famous for its annual regatta in July, a notable event in the British sporting world. The university boat races are held on the river here, and Americans frequently take part in the various open events. Pop. 6,456.

HENLOPEN. See CAPE HENLOPEN.

HENNA, a shrub (*Lawsonia inermis*) resembling the privet, but of the family *Lythraceæ*. It grows in moist situations throughout the north of Africa, Arabia, Persia and the East Indies, and has acquired celebrity from being used by the inhabitants of those countries to dye the nails of their fingers and the manes, hoofs, etc., of their horses. For this purpose the leaves are dried, powdered and made into a paste with hot water, which imparts a yellow color, requiring renewal every three or four weeks. It is cultivated extensively in Egypt, and the powdered leaves form a large article of export to Persia and Turkey. Henna is supposed to be the *kopher* of the Hebrew, translated *camphire* in the Song of Solomon.

HENNEPIN, ĕn-păṅ or hĕn'ĕ-pĭn, **Louis,** French Franciscan missionary and explorer in North America: b. Ath, Belgium, about 1640; d. Utrecht, Holland, about 1706. He entered a convent, and being sent by his superiors to Calais and Dunkirk, the stories he heard from the sailors inspired him with a desire to visit distant countries. At length he embarked for Canada, and arrived at Quebec in 1675. In 1676 he went to the Indian mission at Fort Frontenac, whence he visited the Five Nations and the Dutch settlement at Albany. In 1678 he was attached to La Salle's expedition, and, in company with the Chevalier de Tonty and the Sieur de la Moote, was ordered to sail from Fort Frontenac to Niagara, and there construct a vessel for navigating the Lakes above the falls. This accomplished, La Salle joined the party, and on 7 Aug. 1679 the adventurers began their voyage on Lake Erie. They passed through Lakes Erie, Huron and Michigan, to the mouth of the Saint Joseph's River, ascended this in canoes to the portage, carried their frail barks several miles by land to the Kankakee and floated down this stream and the Iroquois to the Illinois, on the banks of which they built Fort Crèvecœur near the present site of Peoria. After a delay of two months at this place, La Salle returned to Fort Frontenac for supplies, charging Father Hennepin with a voyage of discovery to the source of the Mississippi, which had never been explored above the mouth of the Wisconsin. Accompanied by Picard du Gay and Michael Ako, he set out in a canoe 29 Feb. 1680, followed the Illinois to its mouth and ascended the Mississippi to the Falls of Saint Anthony, which he was the first European to see, and which he named in honor of his patron saint. This was on 30 April.

Arriving at the mouth of the Saint Francis' River, in what is now the State of Minnesota, he traveled by land about 180 miles along its banks, naming it in honor of the founder of his order and visited the Sioux Indians, whom he mentions by the names Issati and Nadouessioux. He stayed with them three months, being, according to his own account, held in captivity, and then, meeting a party of Frenchmen who had come into the country by way of Lake Superior, returned with them to Canada, descending the Mississippi to the Wisconsin, and passing up that river and down the Fox, and so through Green Bay to Lake Michigan. From Quebec he sailed for France, where he published in 1683 his 'Description de la Louisiane nou-vellement découverte au Sud-Ouest de la Nouvelle-France, etc.,' containing the fullest published account of La Salle's first expedition, a history of his second voyage and of Hennepin's own explorations, with a description of the upper Mississippi. Notwithstanding the writer's vanity and fondness for exaggeration, the work is valuable. He put off his clerical dress in Holland about 1697, but to the end of his life seems to have written himself: «Recollect missionary and apostolic notary.» In 1697, 10 years after La Salle's death, Hennepin published his extraordinary 'Nouvelle découverte d'un très-grand pays situé dans l'Amérique entre le Nouveau Mexique et la Mer Glaciale, etc.,' reprinted the next year under the title 'Nouveau voyage dans un pays plus grand que l'Europe, etc.' In this work, which embodies his 'Description de la Louisiane,' written anew and enlarged, he claims to have descended to the mouth of the Mississippi, and to have been the first European who floated on that river. He gives a description of the scenery, Indian tribes and distances along the route, with a minuteness which easily gained him credit for veracity, and explained his long silence on this important point by saying that he feared the enmity of La Salle, who had ordered him to follow a different course, and who prided himself upon his own claims as the first who descended the Mississippi to the Gulf of Mexico. Notwithstanding the utter impossibility of reconciling the dates given in Hennepin's narrative, the story obtained general credence until its falseness was exposed by Jared Sparks. (See 'Life of La Salle,' by Sparks in the 'Library of American Biography'). Consult Saint-Genois, 'Les Voyageurs Belges du XIII au XIX Siècle' (1867); Van Hulet, 'Notice sur le Père Louis Hennepin' (1845); Shea, 'Discovery of the Mississippi' (1852); Parkman, 'La Salle and the Discovery of the Great West'; and especially Winsor, 'Narrative and Critical History of America' (Vol. IV, 1884).

HENNESSEY, William J., Anglo-American artist: b. Thomastown, County Kilkenny, Ireland, 1839. He was brought to New York when 10 years of age, and became a student of the Academy of Design in 1856. He paints in oil and water colors, with a preference for landscape, and draws in black and white as an illustrator. In 1863 he was elected a National Academician, and since 1870 has lived in London, England.

HENNESSY, John, American Roman Catholic bishop: b. Ireland, 20 Aug. 1825; d. Dubuque, Iowa, 4 March 1900. He came to the United States in 1847, and pursued his theological studies in Carondelet Seminary, near Saint Louis. After serving several years as a missionary in Missouri he became professor in Carondelet Seminary in 1854, and its president in 1857. He was afterward pastor in Saint Joseph, Mo.; became bishop of Dubuque in 1866 and archbishop in 1893.

HENNESSY, John Joseph, American Roman Catholic bishop: b. County Cork, Ireland, 19 July 1847. He came to America in early life and was graduated at the Christian Brothers' College, Saint Louis, Mo., in 1862. He was ordained priest in 1869; founded the Railroad Men's Benevolent Union 1871; established the Ursuline convent, Arcadia, Mo., 1877; and edited *The Youth's Magazine,* Saint Louis, 1880-86. He was consecrated bishop of Wichita, Kan., in November 1888.

HENNINGSEN, Charles Frederick, American military officer: b. in England, of Swedish parents, 1815; d. Washington, D. C., 14 June 1877. He joined the Carlists in Spain in 1834, and later was a follower of Kossuth in the Hungarian Revolution. He went to Nicaragua in 1856, where he distinguished himself in the defense of Granada, and in the victory at Queresma. During the Civil War he served in the Confederate army, becoming a brigadier-general. He directed the construction of the first Minie rifles manufactured in the United States. His publications include 'Eastern Europe'; 'Past and Future of Hungary'; 'Sixty Years Hence'; 'Personal Recollections of Nicaragua'; 'The White Slave,' etc.

HENRI, hĕn'rī, **Robert,** American painter: b. Cincinnati, Ohio, 1865. He began his art studies in his native city and became an instructor in the Philadelphia School of Design. He has exhibited in Paris, and his picture 'Snow' was purchased by the French government and hangs in the Luxembourg. While in Paris he gathered round him a group of pupils in his studio, and as a landscape and portrait painter did much to impress younger men with his breadth and vigor of style. While he is a landscape painter of notable attainment, his portraits also are admirable for the power of individualization and the directness which characterizes them. He was elected a member of the National Academy of Design 1906, the Association of American Painters and Sculptors, and the National Institute of Arts and Letters. Among his best-known paintings are 'The Equestrian,' Carnegie Art Institute, Pittsburgh; 'Young Woman in Black,' Art Institute of Chicago; 'Girl with Fan,' Pennsylvania Academy, Philadelphia; 'Laughing Girl,' Brooklyn Institute Museum; 'Spanish Gypsy,' Metropolitan Museum, New York. Other important works are 'The Picador'; 'A Little Gypsy'; portrait of Mrs. W. R. Clarke (1909); 'The Fish-Market Man' (1911); 'La Madrilenita' (1912); 'The Working Man' (1913). In 1914 he exhibited several studies of Irish types. Of these 'Himself' and 'Herself' were shown at the Pennsylvania Academy, where the latter received the medal for the best portrait in the exhibition.

HENRIETTA, Duchess of Orleans: b. Exeter, 16 June 1644; d. Saint Cloud, France, 30 June 1670. She was the daughter of King

Charles I. Her mother fled with her to France, where she was educated a Roman Catholic. Her marriage with the brother of Louis XIV, Philip of France, Duke of Orleans, was celebrated in March 1661. Louis XIV was desirous of detaching her brother, Charles II, from the triple alliance with Holland and Sweden, in order to accomplish his plan of obtaining possession of a part of Holland. She went therefore in 1670 with the court to Flanders, and under pretense of visiting her brother, passed over to Dover, where Charles was awaiting her arrival, and there succeeded in obtaining his signature to the secret treaty of Dover. Shortly after her return she died so suddenly as to excite the suspicion of her being poisoned. Bossuet pronounced her funeral oration.

HENRIETTA, Maria, queen of Charles I of England: b. Paris, 25 Nov. 1609; d. Colombes, near Paris, 31 Aug. 1669. She was the youngest child of Henry IV of France. Her marriage ceremony was celebrated by proxy at Paris in 1625. On Henrietta's first arrival in England she enjoyed great popularity with her husband's subjects, but her attachment to the Roman Catholic faith, combined with her hauteur and despotic ideas as to divine right, soon dissipated these favorable prepossessions. Much of Charles' subsequent arbitrary and injudicious procedure may be traced indirectly to the influence of his queen. On the breaking out of the civil war Henrietta proceeded to Holland, where she procured money and troops for the assistance of her husband, and afterward joined him at Oxford. She again returned to the Continent, and took up her abode in France. Consult 'Lives' by Haynes (1912), and Taylor (1905); and Strickland's 'Lives of the Queens of England.'

HENRIETTA, Tex., town, county-seat of Clay County, on the Little Wichita River, and on the Missouri, Kansas and Texas, and the Fort Worth and Denver railroads, about 90 miles northwest of Fort Worth and 128 miles northwest of Dallas. It is situated in an agricultural and stock-raising region and the building-stone quarries in the vicinity add to the industrial wealth of the town. The chief manufactures are flour and lumber. The town has cotton-gins, grain elevators, lumber-yards and stock-yards. The trade is chiefly in live-stock, grain, flour, lumber, cotton and building-stone. Natural gas is plentiful in the vicinity. The waterworks are the property of the city. Pop. 2,104.

HENRY I, king of England, surnamed BEAUCLERC, youngest son of William the Conqueror: b. Selby, Yorkshire, 1068; d. Rouen, France, 1 Dec. 1135. He was hunting with William Rufus in the New Forest when that prince received his mortal wound in 1100, and instantly going to London caused himself to be proclaimed king, to the prejudice of his elder brother Robert, then absent in the Crusade. To reconcile the people to his usurpation Henry issued a charter containing concessions to public liberty, and also performed another popular act by recalling Anselm, archbishop of Canterbury. In November 1100 he married Matilda, daughter of Malcolm III, king of Scotland. This union strengthened his party, when his brother landed an army in 1101, with a view of asserting his claim to the crown. Actual hostilities were prevented by Anselm, who induced Robert to accept a pension; and it was agreed that in the event of the death of either of the brothers without issue, the other should succeed to his dominions. He subsequently invaded Normandy, and in 1106 took Robert prisoner and reduced the whole duchy. His usurpation of Normandy involved him in continual war, but although William, son of Robert, escaped out of custody, and was assisted by the king of France, Henry maintained possession of the duchy. His only son William was drowned in 1120 in returning from Normandy, and Henry was stricken with grief. He married his only daughter, Matilda, to the Emperor Henry V, and when she became a widow married her a second time to Geoffrey Plantagenet, son of the Count of Anjou. Henry was succeeded by Stephen. Consult Davis, 'England under Normans and Angevins' (1905); Freeman, 'History of the Norman Conquest' (1879); and Norgate, 'England under the Angevin Kings' 1887).

HENRY II, king of England, the first of the line of the Plantagenets: b. Normandy, 1133; d. Castle of Chinon, near Saumur, France, 6 July 1189. He was the son of Geoffrey, Count of Anjou, and the Empress Matilda, daughter of Henry I. He was invested with the duchy of Normandy, by the consent of his mother, in 1150. The next year he succeeded his father in the possession of Anjou and Maine, and by a marriage with Eleanor of Guienne, just divorced from Louis VII, king of France, annexed that province with Poitou to his other dominions. He succeeded Stephen as king of England in 1154. Although involved with his brother Geoffrey, who attempted to seize Anjou and Maine, and in a temporary dispute with France, he reigned prosperously till the memorable contest with Thomas Becket. Anxious to dominate the clergy, Henry in 1164 summoned a general council of nobility and prelates at Clarendon, which assembly passed the famous constitutions named from that place, the effect of which was to render the Church and ecclesiastical dignitaries subject to the temporal authority. (See CLARENDON, CONSTITUTIONS OF). After the murder of Becket, Henry receded from his position and restored the Church to its rights. Before this matter was terminated, Henry, in 1171, undertook an expedition into Ireland, and having left Earl Richard in the post of seneschal of Ireland he returned to England — proceedings so important to the future destinies of both countries having occupied only a few months. Being an indulgent father, Henry had assigned to each of his four sons a provision out of his extensive territories. The eldest son, Henry, was not only declared heir to England, Normandy, Anjou, Maine and Touraine, but actually crowned in his father's lifetime. On paying a visit to the court of his father-in-law, Louis VII of France, the prince was induced by the French monarch to demand of his father the immediate resignation either of the kingdom of England or of the dukedom of Normandy. This request being refused, he withdrew from his father's court and was openly supported in his claim by Louis. Henry's various gallantries, exemplified in the popular and not altogether unfounded legend of fair Rosamond, or Rosamond Clifford, also embroiled him with his queen, Eleanor, who incited her other sons, Richard and Geoffrey, to make similar claims. A general invasion of Henry's dominions was in this way concerted, and began in 1173 by an attack on the frontiers of Normandy, but the king presently subdued his opponents and entered into an accommodation with his sons on less favorable terms than they had previously rejected. Henry now employed himself in regulations and improvements which equally manifest his capacity and love of justice. He partitioned England into four judiciary districts, appointed itinerant justices to make regular excursions through them, revived trial by jury, discouraged that by combat, and demolished all the newly-erected castles as shelters of violence and anarchy. The turbulence of his sons still disquieted him; but Henry, the eldest, was cut off by fever in 1183, and three years after the death of the equally restless Geoffrey occurred. Philip Augustus, then king of France, however, continued to foment the differences between Henry and his sons, and Richard was again prompted to rebel. A war followed, the event of which was so unfavorable to Henry, that he was at length obliged to agree that Richard should receive an oath of fealty from all his subjects. He also stipulated to pay a sum of money to the French king, and to grant a pardon to all Richard's adherents. The mortification of Henry at these humiliating terms was aggravated to despair when he saw the name of his favorite son, John, at the head of the list of delinquents whom he was required to pardon. Henry II ranks among the greatest kings of England. His wisdom and love of justice were acknowledged by foreign potentates, who made him arbiter of their differences and regarded him as the first prince of the age. Consult Stubbs, 'The Early Plantagenets' (1876); Green, Mrs. J. R., 'Henry II' (1888); Norgate, 'England Under the Angevin Kings' (1887); Davis, 'England Under Normans and Angevins' (1905).

HENRY III, king of England: b. Winchester, 1 Oct. 1207; d. Westminster, 16 Nov. 1272. He was the son of John, whom he succeeded in 1216. As Henry approached to manhood he displayed a character wholly unfit for his station. One of his first false steps was to discard his most faithful and able Minister, Hubert de Burgh. In 1236 Henry married Eleanor of Provence, which increased the dislike which his subjects already felt toward him; for she brought a train of foreigners to the court and encouraged her husband in extravagant courses which forced him to all kinds of oppressive exactions to raise money. He received frequent grants of money from Parliament, but always on condition of confirming the Great Charter, which had been extorted from King John. Henry at length raised the national discontent to such a pitch that the nobles rose in rebellion under Simon de Montfort, the Earl of Leicester, the husband of the king's sister; and in 1258 obliged the king to sign a body of resolutions which threw all the legislative and executive power into the hands of an aristocracy of 24 barons, assisted by a lower house consisting of four knights chosen from each county. By the aid of his son Edward, Henry was gradually restored to authority; on which Leicester, calling in Llewellyn, Prince of Wales, involved the kingdom in a civil war. The power of the barons was by this means partially restored; but both parties agreed to abide by the award of Louis IX, king of France. This being favorable to the king, Leicester and the barons refused to submit to it, and a battle was fought near Lewes, in which Henry was taken prisoner and the person of Prince Edward also ultimately secured. A convention provided for the future settlement of the kingdom; but in the meantime Leicester ruled without control. To him, however, was owing the first example of a genuine House of Commons in England; for in a Parliament summoned by him in 1265, deputies from boroughs were sent, as well as knights of shires. Prince Edward at length escaped and, assembling an army, defeated Leicester's son. The decisive battle of Evesham (1265) quickly followed, in which Leicester himself was slain. Replaced upon the throne Henry remained as futile as ever. He died in the 64th year of his age, and the 56th of his reign, the longest in English history, except those of George III and Victoria. He was succeeded by his son, Edward I. Consult Davis, 'England Under Normans and Angevins'; Norgate, 'The Minority of Henry III'; Stubbs, 'Constitutional History of England'; Tout's 'History of England, 1216–1397' and 'Lives of Simon de Montfort.'

HENRY IV, king of England, first king of the house of Lancaster: b. Bolingbroke, 3 April 1367; d. 19 March 1413. He was the eldest son of John of Gaunt, Duke of Lancaster; fourth son of Edward III by the heiress of Edmund, Earl of Lancaster, second son of Henry III. In the reign of Richard II he was made Earl of Derby and Duke of Hereford, and while bearing the latter title appeared in the Parliament of 1398 and preferred an accusation of treason against Mowbray, Duke of Norfolk. The latter denied the charge and offered to prove his innocence by single combat, which challenge being accepted, the king appointed the lists at Coventry; but on the appearance of the two champions at the appointed time and place, Richard would not suffer them to proceed. Both were banished the kingdom, Norfolk for life and Hereford for 10 years, shortened by favor to four, with the further privilege of immediately entering upon any inheritance which might accrue to him. On the death of John of Gaunt in 1399 he succeeded to the dukedom of Lancaster, and laid claim, according to agreement, to the great estates attached to it; but Richard retained possession of the estates. The duke therefore, disregarding the unfinished term of his exile, landed with a small retinue at Ravenspur in Yorkshire, where he was quickly joined by the earls of Northumberland and Westmoreland, and soon found himself at the head of 60,000 men. Richard falling into the hands of his enemies, was brought to London by the duke, who now began openly to aim at the crown. A resignation was first obtained from Richard, who was then solemnly deposed in Parliament; and Henry unanimously declared lawful king under the title of Henry IV. The death of Richard soon removed a dangerous rival; yet a short time only elapsed before the nobles rebelled against the king of their own creation. The first plot, in 1400, was discovered in time to prevent its success, but an insurrection in Wales, under Owen Glendower, proved more formidable. That chieftain having captured Mortimer, Earl of March, who was descended from Lionel, Duke of Clarence, the second son of Edward III, and therefore the lineal heir to the crown, Henry would not suffer his relation, the Earl of Northumberland, to treat for his ransom. He thus offended that powerful nobleman, who, with his son, the famous Hotspur, soon after joined Glendower. The king met the insurgents at Shrewsbury, and a furious battle ensued, 21 July 1403, which ended in the death of Percy and the defeat of his party. A new insurrection, headed by the Earl of Nottingham and Scrope, the archbishop of York, broke out in 1405, which was suppressed by the king's third son, Prince John. The archbishop afforded the first example in this kingdom of capital punishment inflicted upon a prelate. The rest of this king's reign was comparatively untroubled. Henry was succeeded by his son of the same name. Consult Wylies, 'Henry IV' (4 vols., 1894–98); Ramsay, 'Lancaster and York' (1892); Oman's 'Political History of England, 1377–1485' (1906); and Stubbs, 'Constitutional History of England.'

HENRY V, king of England: b. Monmouth, 19 Aug. 1387; d. Vincennes, France, 31 Aug. 1422. He succeeded his father, Henry IV, in 1413. His dissipated youth, and fondness for joviality and low company, gave his father much uneasiness; but circumstances occurred, even in the midst of his wildness, which showed that better principles were latent in his mind. His conduct when he ascended the throne justified the best expectations. The circumstances of France, torn asunder by the opposing factions of the dukes of Orleans and Burgundy, afforded a tempting opportunity to an ambitious neighbor, and Henry was easily induced to revive the claims of his predecessors upon that country. He accordingly assembled a great fleet and army and landed near Harfleur, 14 Aug. 1415. He took that town after a siege which so much reduced his army that he was advised to return to England by sea. But Henry determined to march on Calais, and on his way was met on the plain of Agincourt by a French army 10 times as numerous as his own. A battle took place there on 25 October, in which the French host was totally defeated, with a comparatively trifling loss on the side of the English. In 1417 the liberal grants of the Commons enabled Henry once more to invade France with 25,000 men. By the famous Treaty of Troyes (21 May 1420), Henry engaged to marry the Princess Catharine and to leave Charles in possession of the crown on condition that it should go to Henry and his heirs at his decease, and be inseparably united to the crown of England. Henry, after espousing Catharine, took possession of Paris and then went over to England to raise recruits for his army. All his great projects seemed about to be realized, when he was attacked by a disease which carried him off at the age of 34, and in the 10th year of his reign. He was succeeded by his son, Henry VI. Henry V, as the gallant, youthful and successful conqueror of France, is a favorite name in English history; but he was inferior in wisdom and solid policy to many of his ancestors. Consult Kingsford, 'Henry V' (1911), and Oman, 'Political History of England, 1377–1485' (1906).

HENRY VI, king of England: b. Windsor, 6 Dec. 1421; d. London, 21 May 1471. He was crowned at Westminster in November 1429 and at Paris in December 1430. As he was not nine months old at the death of his father, Henry V, John, Duke of Bedford, a brother of the late king, was appointed regent of France; and Humphrey, Duke of Gloucester, another brother of the same, protector of the realm of England, with a council at his side appointed by Parliament. A few weeks after Henry's succession, Charles VI of France died, when, according to the provisions of the Treaty of Troyes, Henry was proclaimed king of France. But the French did not quietly submit and a war began, at first favorable to the English, but in the end, after they had been roused to more effectual efforts by the heroism of Joan of Arc (q.v.) (1428–30), resulted in the almost total loss to the English of their possessions in France. In 1453 nothing remained to them in that country but Calais. In April 1445, Henry married Margaret of Anjou, daughter of René of Provence. Two years later the Earl of Suffolk acquired the chief power in the kingdom and was created first marquis and then duke. His government was very unpopular, which caused the people to look to the claim of Richard, Duke of York. The insurrection of Cade followed and the Duke of York was by Parliament declared protector of the kingdom. The York and Lancaster parties were now in such a state that the sword only could decide between them; and that course of civil contention commenced, the first bloodshed in which occurred at Saint Albans in May 1455, and as far as the reign of Henry was concerned, the last in the battle of Tewkesbury in 1471. When the latter took place the king was a prisoner in the Tower, where he soon after died, but whether by a natural or violent death is uncertain. Henry was gentle, pious and well-intentioned, but weak. Eton College reveres Henry as its founder, as does likewise King's College, Cambridge. Consult Gairdner, (ed.), 'The Paston Letters'; Oman, 'Political History of England, 1377–1485' (1906); and Stubbs, 'Constitutional History of England' (Vol. III, 1895); Vickers, 'England in the Later Middle Ages' (New York 1914).

HENRY VII, king of England, first sovereign of the house of Tudor: b. Wales, 28 Jan. 1457; d. Richmond, Surry, 22 April 1509. He was the son of Edmund, Earl of Richmond, son of Owen Tudor and Catharine of France, widow of Henry V. His mother, Margaret, was the only child of John, Duke of Somerset, grandson of John of Gaunt. After the battle of Tewkesbury he was carried by his uncle, the Earl of Pembroke, to Brittany, to seek refuge in that court from the jealousy of the victorious house of York. On the usurpation of Richard the young Earl of Richmond was naturally turned to as the representative of the house of Lancaster. In 1485 Richmond landed at Milford Haven, where he was immediately joined by some leaders of rank, but had only 6,000 men when Richard met him at Bosworth, with an army twice as numerous in appearance; but the defection of Lord Stanley with his forces, who joined Richmond during the battle, obtained for the latter a complete victory. Henry was proclaimed king on the field of battle, and his right was subsequently recognized by Parliament. In 1486 he married Elizabeth, daughter of Edward IV and heiress of the house of York, and thus united the claims of the rival houses of York and Lancaster. The reign of Henry VII was troubled by repeated insurrections. The project of France for annexing the province of Brittany, by marriage with the heiress, induced Henry to declare war, but his measures were so tardy and parsimonious that the annexation was effected. He then raised large sums on the plea of the necessity for hostilities; and landing a numerous army at Calais in 1492, almost immediately accepted a large compensation for peace. The Duchess-dowager of Burgundy, governess of the Low Countries, now advocated the cause of Perkin Warbeck, a youth who gave himself out to be Richard Plantagenet, the younger of the two sons of Edward IV, supposed to have been murdered in the Tower of London, and the justice of his claim has been maintained even by some historians of a recent date. The duchess professed to be satisfied with the proofs of his identity, and acknowledged him as her nephew. He was so far successful as to secure a large following, with which he marched to Taunton; but there his heart failed him and he fled. Captured by Henry he confessed himself an impostor and was sent to the Tower, where he became acquainted with the Earl of Warwick and persuaded him to accompany him in an attempt to escape. They were both retaken and Warwick was recommitted to the Tower and Perkin Warbeck hanged at Tyburn (1499). Soon after the king ordered the Earl of Warwick also to be executed. After a long negotiation he brought about a match between the Infanta Catharine, daughter of Ferdinand of Aragon and of Isabella of Castile, and his eldest son Arthur; and on the death of the latter, in order to retain the dowry of this princess, caused his remaining son Henry to marry the widow by Papal dispensation, an event which, in the sequel, led to a separation from the see of Rome. He married his eldest daughter to James IV, king of Scotland, from which union there ultimately resulted the union of the two crowns. His reign was, upon the whole, beneficial to his country. Being conducted upon pacific principles it put a period to many disorders and gave an opportunity to the nation to flourish by its internal resources. His policy of depressing the feudal nobility, which proportionably exalted the middle ranks, was highly salutary; and it was especially advanced by the statute which allowed the breaking of entails and the alienation of landed estates. It was under the patronage of Henry VII that John Cabot made his voyage of 1497 and discovered the North American continent. Consult Bacon's 'History of Henry VII' (ed. by Lumby, 1881); Gairdner's 'Henry VII' (1889); and 'Lives,' by Pollard (1913–14) and Temperley (1914).

HENRY VIII, king of England: b. Greenwich, 28 June 1491; d. Westminster, 28 Jan. 1547. He succeeded his father, Henry VII, in 1509. His disposition for show and magnificence soon squandered the hoards of his predecessor. James IV, king of Scotland, made an incursion with a numerous body of troops into England, and was completely defeated and slain at the battle of Flodden Field (1513). Henry, however, granted peace to the queen of Scotland, his sister, and established an influence which rendered his kingdom long secure on that side. The aggrandizement of Cardinal Wolsey now began to give a leading feature to the conduct of Henry, that prelate being appointed chancellor in 1515. His favor was now sought by Maximilian I, emperor of Germany, who hoped to secure the support of England against France, and as Wolsey was at first neglected by the French king the German emperor gained his point; but when Maximilian was succeeded by Charles V, hereditary king of Spain as well as emperor of Germany, Francis I, king of France, found it expedient to gain Wolsey, and entered into an amicable correspondence with them. In order to cement this new friendship the two monarchs had an interview near Calais, the magnificence of which gave the place of meeting the denomination of the Field of the Cloth of Gold (1520). Notwithstanding these indications, a prospect of the papacy being artfully held out to the cardinal by the young Emperor Charles, his interest at length gained a preponderance in the English councils. The principles of the Reformation were now making rapid strides. Henry himself wrote a Latin book against the tenets of Luther, which he presented to Pope Leo X, who favored him in return with the title of defender of the faith, a title by which, curiously enough, English sovereigns are still styled. After being married to Catharine for about 18 years, Henry began to feel some scruples as to the validity of the marriage, on the ground that she had previously been his brother's wife, and his scruples were no doubt increased by the fact of his having conceived a passion for Anne Boleyn, one of the queen's maids of honor. He accordingly applied in 1527 to Pope Clement VII for a divorce, and the Pope appointed Cardinals Wolsey and Campeggio to try the case. Wolsey had at first been favorable to the project of a divorce, but when he perceived the desire of Henry to marry Anne Boleyn, fearing that this marriage would result in winning over Henry to the side of the reformers, since Anne Boleyn's friends belonged to that party, he did all in his power to prolong the inquiry, until the commission was at last withdrawn and it was decided by the Pope that the case should be tried at Rome. This procrastination on Wolsey's part led to his own ruin. Henry, disgusted at these delays, eagerly caught at the advice of Thomas Cranmer (q.v.), afterward archbishop of Canterbury, to refer the case to the universities, from whom he got the decision desired. In May 1533 his marriage with Catharine was declared null, and as he had by that time privately married Anne Boleyn, this second marriage was a few days later declared lawful. As these decisions were not recognized by the Pope, an act of Parliament was obtained in the following year (1534), setting aside the authority of the chief pontiff in England, which was followed by another in 1535 declaring Henry the supreme head of the Church. Thus was effected the great revolution by which, in ecclesiastical annals, this reign is so much distinguished. The birth of a daughter by the new queen produced a bill for regulating the succession, which settled it on the issue of this marriage, and declared the king's daughter by Catharine illegitimate. But although Henry discarded the authority of the Roman Catholic Church, he adhered to its theological tenets. While he executed Bishop Fisher and Sir Thomas More (who had been appointed chancellor after the fall of Wolsey) in 1535, for refusing the oath of supremacy, he displayed an aversion to the principles of the reformers and brought many of them to the stake. Finding that the monks and friars in England were the most direct advocates of the papal authority, he suppressed the monasteries by act of Parliament. The fall of Anne Boleyn was, however, unfavorable for a time to the reformers. Henry then married Jane Seymour, and the birth of Prince Edward in 1537 fulfilled his wish for a male heir, although his joy was abated by the death of the queen. Henry now resolved to marry again, and Thomas Cromwell, a Protestant, who had succeeded More as first minister, recommended Anne of Cleves. The marriage took place in January 1540, and Henry created Cromwell Earl of Essex; but his dislike to his new wife hastened the fall of that minister, who was condemned and executed upon a charge of treason. At the same time Henry procured from the convocation and Parliament a divorce from Anne of Cleves. He then married Catharine Howard, niece to the Duke of Norfolk; but Henry found that his new queen, of whom he was very fond, had proved false, and on further inquiry her conduct before marriage was discovered to have been loose and criminal. She was therefore accused and brought to the block in 1542. In 1543 he married his sixth wife, Catharine Parr, widow of Lord Latimer, a lady of merit, secretly inclined to the Reformation.

Henry was succeeded by his son, Edward VI. The complete union of Wales with England, and the conversion of Ireland into a kingdom, date from the reign of Henry VIII.

Consult Histories of England by Lingard (1854–55); Froude (1870); and Green (1879 and 1884); also Brewer, ‘History of the Reign of Henry VIII to the Death of Wolsey’ (1884); Dixon, ‘History of the Church of England from the Abolition of the Roman Jurisdiction’ (1884–91); Froude, ‘The Divorce of Catharine of Aragon’ (1891); Gairdner, ‘The English Church in the 16th Century’ (1902); Hume, ‘The Wives of Henry VIII’ (1905), and monographs by Creighton (1888), and Pollard (1902). The ‘Letters and Papers, Foreign and Domestic,’ for his reign, which are the principal sources, were published in 21 volumes, between 1862 and 1910.

HENRY I, king of France: b. 1005; d. Vitri, 4 Aug. 1060. He was the third son of Robert II. He succeeded in 1031. His reign was a continuous series of difficulties with the nobility and with the growing power of the clergy. His younger brother, Robert, led a revolt against him, but this he suppressed with the aid of Duke Robert of Normandy. Consult Lavisse, ‘Histoire de France’ (Vol. II, 1901).

HENRY II, king of France: b. Saint Germain-en-Laye, 31 March 1519; d. 10 July 1559. He succeeded his father, Francis I, 31 March 1547. He severely persecuted the Huguenots, and was involved in wars with the Emperor Charles V and Philip II of Spain. The Constable de Montmorency was defeated at Saint Quentin (10 Aug. 1557); the Marshal de Thermes at Gravelines (13 June 1558); and the Peace of Cateau-Cambrésis (3 April 1559) lost to France most of the advantages previously gained. Henry was a monarch of slight capability, despite his regal bearing. Consult Williams, H. N., ‘Henri II: His Court and Times’ (1911).

HENRY III, king of France: b. Fontainebleau, 19 Sept. 1551; d. by assassination Saint Cloud, 2 Aug. 1589. He was the third son of Henry II. He fought, as Duke of Anjou, against the Huguenots, was elected king of Poland in 1573 and crowned 15 Feb. 1574, but in June 1574 left Poland and succeeded his brother, Charles IX, as king of France. The Peace of Beaulieu (1576), confirmed by the Edict of Poitiers (1577), granted to the Huguenots so many privileges that the Holy League was formed, seeking openly Catholic supremacy and secretly the elevation of Henry of Guise to the French throne. When all privileges granted to Huguenots were repealed by the Edict of Nemours (1585) war broke out. Henry of Navarre was victor at Coutras, while Henry of Guise drove the king from Paris. The king then caused the murder of Guise and Guise's brother, the cardinal of Lorraine, in consequence of which the doctors of the Sorbonne absolved the people from obedience to him. He then joined cause with Henry of Navarre, with whom he marched against Paris; but in camp at Saint Cloud was stabbed by Jacques Clément, a fanatical Dominican, 1 Aug. 1589. Henry III was the last of the branch of Orléans-Angoulême of the stock of the Valois. Consult Armstrong, ‘The French Wars of Religion’ (1892), and Freer, ‘Henri III: His Court and Times’ (1858).

HENRY IV, known as HENRY OF NAVARRE, king of France: b. Pau, 13 Dec. 1553; d. 14 May 1610. He was a son of Anthony of Bourbon, Duke of Vendôme, and of Jeanne d'Albret, daughter of Henry, king of Navarre, and herself afterward queen of Navarre. Educated by his mother in the Calvinistic faith, he early joined, at her wish, the Protestant army of France, and served under Admiral Coligny. In 1572 he married Margaret of Valois, sister of Charles IX, and after the massacre of Saint Bartholomew, which took place during the festivities in connection with this marriage, adopted the Roman Catholic creed. For the next four years he was compelled to reside in Paris, but 3 Feb. 1576 succeeded in making his escape, and after retracting, at Tours, the abjuration of Calvinism which he had made at Paris, put himself at the head of the Huguenots and took a leading part in all the subsequent religious wars. He occupied a still more important position when, in 1584, the death of the Duc d'Anjou, brother of the king (Henry III), made him presumptive heir to the Crown as descended from Robert, Count of Clermont, the sixth son of Louis IX. Rejected by the Roman Catholic party and the League as a heretic, Henry found himself obliged to resort to arms to assert his claims. On 20 Oct. 1587 with an inferior force he defeated the army of the League at Coutras. In 1589 he became king through the assassination of Henry III (q.v.), but found innumerable difficulties in establishing his claims. His Protestant religion was brought forward by all the competitors to prejudice the Catholics against him. At the head of the opposite party stood the Duke de Mayenne. Philip II of Spain also claimed the French throne and sent aid to the League. Henry IV defeated his enemies in the celebrated engagement of Ivry (14 March 1590). In consequence of this victory Paris was besieged, and Henry IV was upon the point of compelling the citizens to surrender by famine, when the Spanish general, Alexander, Duke of Parma, by a skilful maneuver, obliged him to raise the siege. Convinced that he should never enjoy quiet possession of the French throne without professing the Catholic faith, Henry at length yielded to the wishes of his friends, was instructed in the doctrines of the Roman Church, and professed the Catholic faith, 23 July 1593, in the church of Saint Denys. He was anointed king at Chartres in 1594, and entered the capital amid the acclamations of the people. He quickly brought France entirely into subjection, and concluded the war against Spain in 1598 by the Peace of Vervins, to the advantage of France. The same year was signalized by the granting of the Edict of Nantes, which secured to the Protestants entire religious liberty and freed them from all political disabilities. Henry made use of the tranquillity which followed to restore the internal prosperity of his kingdom, and particularly the wasted finances. In this design he was so successful, with the aid of his prime minister Sully, that the national debt of 350,000,000 livres was diminished by 125,000,000, and 41,000,000 livres were laid up in the treasury. As Henry was riding through the streets of Paris he was stabbed by the fanatic Ravaillac.

The great benefits which Henry IV bestowed upon France entitle him to the designation which he himself assumed at an assembly of the Notables at Rouen in 1596, the Regenerator of France. His benevolent mind, his paternal love for his subjects, his great achievements, his heart, always open to truth, though it exposed his own faults, have preserved his memory in the hearts of the nation. To the end of his life he had to contend against the governors of provinces, Protestant as well as Catholic, who had rendered themselves almost independent under the last kings of the house of Valois. Many of the acts of his internal government show that, while he aimed at restoring the prosperity of the nation by encouraging agriculture, commerce and manufacturing industries, he was determined by all means in his power to strengthen the authority of the Crown. In his foreign policy Henry IV revived the projects of Francis I and Henry II against the house of Austria, and re-established the influence of France in the Catholic states of Italy. He supported Holland in its revolt against Spain; allayed the bitterness of feeling between the Lutherans and the Calvinists, and induced them to form the Evangelical Union. Consult Burton, 'The Fate of Henry of Navarre' (1911); Lacombe, 'Henri IV et sa Politique' (1878); Péréfisce, 'Memoirs of Henri IV' (Eng. trans., 1904); Poirson, 'Histoire du règne de Henri IV' (1862–67); Willert, 'Henry of Navarre and the Huguenots in France' (1893).

HENRY V (of France). See Chambord, Comte de.

HENRY I, emperor of Germany: b. about 876; d. Memleben, 2 July 936. He was the son of Otho I, the Illustrious, Duke of Saxony, who had refused the regal dignity offered him in 912. Henry, on the death of his father, became Duke of Saxony and Thuringia. He was chosen king of the Germans by the Franks and Saxons, April 919, at Fritzlar. The surname der Finkler or der Vogler (the Fowler), sometimes applied to him, did not arise until the 12th century, and is based upon the unauthentic legend that the princes who notified him of election found him at fowling. He subdued Duke Giselbert of Lorraine, and in 924 concluded with the Hungarians a nine-years' treaty of peace, with the condition that he should pay a yearly tribute. This tribute he finally refused (933), whereupon the Hungarians invaded his realm with two large armies which he defeated, the one near Göttingen, the other at Riade (Riethenburg). In 934 he waged a victorious contest against the Danes. He thoroughly reorganized the German defensive military system, built fortified cities and fortified others. Though he did not technically possess the title of emperor, he was the real founder of the mediæval German empire, and is recognized as a wise ruler and skilful military leader.

HENRY II, the Lame, emperor of Germany: b. 6 May 973; d. Grona, near Göttingen, 13 July 1024. He was the last of the Saxon line, a son of Henry the Quarreler of Bavaria, and great-grandson of the Emperor Henry I. He inherited Bavaria on the death of his father in 995. On the death of Otho III in the beginning of 1002 he laid claim to the kingdom, and was crowned at Mainz 7 June. He was for a time busily occupied in wars with Duke Boleslav II of Bohemia, the Margrave Henry of Schweinfurt, and the Margrave Ernest of Austria. In 1004 and 1013 he was obliged to make expeditions to Italy, where Arduin of Ivrea was twice chosen king. Having thoroughly defeated his opponent, he was invested with the imperial insignia at Rome by Pope Benedict VIII, 14 Feb. 1014. His somewhat protracted struggle with Boleslav of Poland ended without any considerable success. At the call of the Pope he fought against the Greeks in lower Italy. For his zeal in the interests of the Church he was canonized by Eugenius III in 1146. Consult Cohn, 'Kaiser Heinrich II' (1867); Hirsch, 'Jahrbücher des deutschen Reichs unter Kaiser Heinrich II' (1874).

HENRY III, variously surnamed the Old, the Black, and the Pious, emperor of Germany: b. Osterbeck, Netherlands, 28 Oct. 1017; d. Botfeld, 5 Oct. 1056. He was the second of the house of the Salian Franks, son of the Emperor Conrad II, whom he succeeded in the imperial dignity 1039. He had already been chosen king in 1026. He weakened the power of the nobles by keeping the great fiefs when they became vacant for himself or members of his family, or by bestowing them upon less powerful nobles than had previously possessed them. He also extended the power of the empire by forcing the Duke of Bohemia in 1042, and the king of Hungary in 1044, and again in 1047, to accept their dominions as imperial fiefs. His influence was paramount in Italy, especially in the south, where the Normans in Apulia and Calabria paid homage to him as their feudal chief. On the occasion of his first visit to Italy (1046) he put an end to the contention between Benedict IX, Sylvester III and Gregory VI for the papacy, causing them all to be deposed, and Suitger, bishop of Bamberg, to be elected in their stead with the title of Clement II. His efforts were now directed toward rooting out the evils which were rife among the clergy, but not less toward securing the permanence of the influence of the empire over the See of Rome. Henry III was not only a powerful ruler, but also a patron of arts and sciences. He founded numerous schools in connection with the monasteries and built the cathedrals of Worms, Mainz and Spiers. Consult Steindorff, 'Jahrbücher des deutschen Reichs unter Heinrich III' (1874–81).

HENRY IV, emperor of Germany: b. 11 Nov. 1050; d. Liège, 7 Aug. 1106. He was the son of Henry III. He was crowned at Aix-la-Chapelle in 1054. His reign was from the first disturbed by contests with his vassals. The Saxons joined with the inhabitants of Thuringia, drove Henry from Saxony (1073), and destroyed many of the castles which he had built to overawe the inhabitants. But some churches having been destroyed by the populace, Henry accused the Saxons to the Pope of sacrilege and thus gave him an opportunity to interfere as umpire. The Saxons offered to make every satisfaction; but Henry suddenly invaded their territory with a powerful army, and attacked them 9 June 1075, at Hohenburg, on the Unstrut, where they suffered a total defeat. He imprisoned nobles and ecclesiastics, and aroused the attention of the papacy. Gregory VII (Hildebrand), who had been elevated to the papal chair some years before without the consent of the imperial court, eagerly seized this opportunity to challenge Henry's usurpation of the power of investing bishops with the spiritual insignia of office, and in December 1075 presented to the king a list of charges and demanded proofs of obedience to the Church. Henry then instigated the bishops, assembled by his order at Worms, to renounce their obedience to the Pope (24 Jan. 1076). Gregory, however, pronounced the sentence of excommunication against him (22 Feb.), and absolved his subjects from their allegiance, and Henry soon found himself deserted. In this state of affairs he was obliged to go to Italy and make his submission to the Pope. He found Gregory at Canossa, not far from Reggio, a strong castle belonging to Matilda, countess of Tuscany, whither he had retired for security. Three days successively, in the depth of winter, Henry appeared in a penitential dress in the court of the castle, before the intercession of Matilda obtained for him an audience of the Pope (28 Jan. 1077), when he was released from the sentence of excommunication only upon submitting to the most humiliating conditions. Some of the Italian princes, who had long been dissatisfied with Gregory and were desirous of deposing him, gathered round Henry, who was not disposed to fulfil the hard conditions imposed upon him, and offered him their assistance. The German princes, however, at the instigation of the Pope, assembled at Forchheim in 1077, and elected Rudolf, Duke of Swabia, king. Henry hastened back to Germany and overcame his rival, who lost his life in battle at Merseburg in 1080. Gregory again excommunicated Henry; but at the councils of Brixen and Mainz in 1080, the Pope was declared deposed by the German bishops as a heretic and a sorcerer, and Guibert, archbishop of Ravenna, set up in his place, with the title of Clement III. In 1081 Henry marched into Italy to take vengeance on Gregory, and appeared at Easter before Rome. He was not able in that year, however, to pursue the siege of the city, which did not fall into his hands till 1084. He was forced by a conspiracy of the majority of the nobles, led by his son, Henry V, to abdicate at Ingelheim 31 Dec. 1105. Consult von Kronan, 'Jahrbücher des deutschen Reiches unter Heinrich IV and Heinrich V' (1890–1909).

HENRY V, emperor of Germany: b. 8 Jan. 1081; d. Utrecht, 23 May 1125. He was the son and successor of Henry IV. He was crowned emperor in 1111. His reign was continually disturbed by troubles with the papacy. He was excommunicated no less than four times, and finally in the concordat of Worms (23 Sept. 1122) conceded the advantage to the Pope. He also carried on wars with Flanders, Hungary, and Poland, and with various German nobles. He was the last of the Salic or Frankish family of emperors, which was succeeded by the Swabian house. Consult von Kronang, 'Jahrbücher des deutschen Reichs unter Heinrich IV and Heinrich V' (1890–1909).

HENRY VI, the CRUEL, emperor of Germany: b. 1165; d. Messina, 28 Sept. 1197. He was the son of Frederick I (Barbarossa), was crowned king in 1169, and succeeded his father as emperor in 1190. He was involved in wars in Italy to assure his possessions there. It was during his reign that Richard Cœur de Lion, returning from Palestine, was imprisoned by Leopold of Austria and surrendered to the emperor, who exacted a heavy ransom. Consult Toch, 'Jahrbücher des deutschen Reichs unter Heinrich VI' (1867).

HENRY VII, OF LUXEMBURG, emperor of Germany: b. 1269; d. Buonconvento, Italy, 24 Aug. 1313. He was son of the Count of Luxemburg, and was chosen king of the Romans, 27 Nov. 1308, and crowned at Aix-la-Chapelle, 6 Jan. 1309. In 1311 he received the iron crown of the Lombards, and 29 June 1312 was crowned emperor at the Lateran. His march into Italy at the head of a Ghibelline army (October 1310) was hailed by Dante, who did homage at some time and place unknown. His sudden death immediately after reception of the Eucharist led to the unfounded rumor that he had been poisoned.

HENRY, prince of Portugal, surnamed the NAVIGATOR: b. 4 March 1394; d. 13 Nov. 1460. He was a grandson of old John of Gaunt; nephew of Henry IV of England; and great-grandson of Edward III. His father, King João or John, who formed a close English connection by marrying Philippa of Lancaster, was the first king of the house of Avitz, under which Portugal, for 200 years, rose to its highest prosperity and power. The career of Portugal in exploration and discovery, due to the genius and devotion of Prince Henry, his biographer characterizes as «a phenomenon without example in the world's history, resulting from the thought and perseverance of one man.» Prince Henry had become one of the first soldiers of his age when, in 1420, he refused offers of military command, and undertook to direct, at Sagres (the extreme point of land of Europe looking southwest into the Atlantic Sea of Darkness), plans of exploration of the unknown seas of the world lying to the west and south. His idea was to overcome the difficulties of the worst part of that immense world of storms, that lying west of Africa, and thereby get round Africa to the south and sail to India, and China, and the isles beyond India. Every year he sent out two or three caravels; but his great thought and indomitable perseverance had yielded only «twelve years of costly failure and disheartening ridicule,» when, in 1434, the first great success was achieved by Gil Eannes, that of sailing beyond Cape Bojador. Prince Henry made his seat at Sagres, one of the most desolate spots in the world, a school of navigation, a resort for explorers and navigators. His contemporary Azurara says of him: «Stout of heart and keen of intellect, he was extraordinarily ambitious of achieving great deeds. His self-discipline was unsurpassed; all his days were spent in hard work, and often he passed the night without sleep; so that by dint of unflagging industry he conquered what seemed to be impossibilities to other men. His household formed a training-school for the young nobility of the country.» Consult ‹Lives› by Beazley (1895), and Major (1868); Martin, ‹The Golden Age of Prince Henry the Navigator› (1911).

HENRY, prince of Prussia (HEINRICH ALBERT WILHELM) German naval officer: b. Potsdam, 14 Aug. 1862. He is a brother of Emperor William II, and married Princess Irene, daughter of the late Grand Duke Ludwig IV, of Hesse, in 1888. He was educated in the Gymnasium at Kassel (1875–77) and at the Marine Academy (1884–86). He succeeded vice-admiral von Diederichs in command of the German fleet in Chinese waters, in March 1899, became admiral in 1901, chief of the active battleship fleet in 1906. He traveled around the world in 1878–80, and visited the United States in 1882–84, and again in 1902. In January 1902, Emperor William requested that the President's daughter, Alice, should christen the royal yacht then building in the United States. After receiving the consent of President Roosevelt, the emperor informed the President that he had ordered his yacht, the *Hohenzollern*, to be present at the ceremony, and had appointed his brother, Admiral Prince Henry of Prussia, to represent him on the occasion. The prince arrived in New York city on 23 February and left on 12 March, after receiving many national, municipal and social honors. He traveled in South America in 1914, and at the outbreak of the European War in the same year he held the chief command of the German fleet.

HENRY, surnamed THE LION, Duke of Saxony and Bavaria: b. Ravensburg, 1129; d. Brunswick, 6 Aug. 1195. He was the son of Henry the Proud and the head of the Guelphs. He greatly enlarged his domains, and so increased in power as finally to become a dangerous rival of the emperor Frederick I, Barbarossa. His refusal to support Frederick was among the chief causes of the latter's defeat at Legnano (29 May 1176). He was summoned to appear at three Diets, and, having failed to attend was placed under the Imperial ban (1180). Later he was allowed to retain Lüneburg and Brunswick upon condition of going for three years into exile. He was finally reconciled with Henry VI.

HENRY, Alexander, American traveler: b. New Brunswick, N. J., August 1739; d. Montreal, 4 April 1824. He joined the Canadian expedition under Amherst against the French (1760) and when peace followed he went to Michilimackinac and engaged in the fur trade. After the massacre of the English by the Indians in that place he, being one of the few survivors, remained a captive among the Ojibways at Sault Sainte Marie for 12 months, when he escaped and resumed the fur trade. In the pursuit of this business he traveled between Montreal and the Rocky Mountains, the literary result of which was a remarkable book, ‹Travel and Adventures in Canada and the Indian Territories between the years 1760 and 1776,› published at New York in 1809. He interested himself in the copper mines on Lake Superior and for many years made an effort to establish a company for their exploitation. Consult Bain's edition of the ‹Travels and Adventures› (Toronto 1901); and Ginnell, ‹Trails of the Pathfinders› (1911).

HENRY, Edward Lamson, American painter: b. Charleston, N. C., 12 Jan. 1841. He began his artistic studies at the Philadelphia Academy and in 1860 went to Paris where he studied for three years under Saisse and Courbet. In 1869 he was elected a member of the National Academy. He has frequently revisited Europe for the purpose of sketching the scenery, although his specialty is domestic genre and history. In the Albany Historical Society building is one of his most characteristic pictures, which shows his careful grouping of figures, his attention to detail as well as the stiffness of his drawing and his deficiency in the sense of color which recalls Wilkie, whose swing and movement he lacks, though he exhibits some of the humor of the Scottish master. The picture referred to is a crowded canvas of 63 figures with the title ‹Initial Excursion of the First Railway Ever Constructed in New York State.› Among his historical pictures the best are ‹Battle of Germantown,› owned by William Astor; ‹Declaration of Independence,› owned by J. W. Drexel; ‹Reception to Lafayette›; ‹The Return of the First Congress›; ‹City Point, Grant's Headquarters'; 'In Sight of Home,' and 'Waiting for an Answer.'

HENRY, Guy Vernon, American soldier: b. Fort Smith, Indian Territory, 1839; d. Ponce, Porto Rico, 1899. He was graduated at West Point 1861, and went to the front in the Civil War, taking part in four years of the hardest fighting, from Bull Run to Cold Harbor. At 23 he was commissioned colonel of the 40th Massachusetts volunteers. After the Civil War he was transferred to the 3d cavalry, and in 1874 was in Arizona. He continued his Indian campaign, though severely wounded on one occasion, and compelled to be invalided. He served through the outbreak of the Sioux in 1890, and was also on service at Porto Rico during the Spanish-American War, where he died of typhoid fever.

HENRY, Joseph, American physicist: b. Albany, N. Y., 17 Dec. 1797; d. Washington, D. C., 13 May 1878. He was educated at the Albany Academy, after graduation undertook the study of chemistry, anatomy and physiology with a view to adopting the medical profession. During the years 1824–25, he contributed occasional scientific papers to the Albany Institute, his especial subjects being chemistry and mechanics, and was appointed assistant engineer on the survey instituted for a road between Lake Erie and the Hudson. In the spring of 1826 he was elected teacher of mathematics and natural philosophy in the Albany Academy and in the latter part of 1827 read a very important paper before the Albany Institute, 'On Some Modifications of the Electro-Magnetic Apparatus.' He made his first public demonstration of his magnetic discoveries in exhibiting before the Institute small electro-magnets wound with silk-covered wire. These magnets had a greatly multiplied lifting power over any that had yet been known. In this lay the essential point of his first discovery, for he was undoubtedly the earliest physicist to adopt insulated or silk-covered wire for the magnetic coil, and to employ spool winding for the limb of the magnet. He demonstrated also for the first time, by a very intelligent experiment, the difference of action in a quantity magnet excited by a quantity battery of a single pair, and an intensity magnet with a long fine wire coil excited by an intensity battery of many elements, having their resistances suitably proportioned. The first of these two forms was not capable of being employed for telegraphic purposes, while the intensity magnets with their attachments could be so applied. The quantity magnets which he exhibited caused a good deal of excitement in the scientific world. Their attractive power was at that time quite unprecedented. One of them had sufficient power to raise as much as 3,500 pounds.

Henry was the first to show that iron could be magnetized at a distance, and to invent a suitable combination of magnet and battery for the production of this result. In 1831 he made this experimental demonstration. He suspended a mile of insulated copper wire round a chamber in the Academy, and so placed a bell at one extremity of it that it was struck by the polarized armature of an intensity battery connected with the other extremity. This was the earliest example of the magnetic telegraph, for the galvanometer or needle had been the principle on which all preceding experiments had been conducted. It was not long after that he invented a machine, and finally constructed it, which is recognized as the first electro-magnetic engine with automatic pole-changer. In 1832 after repeated experiments he discovered how to give greater intensity to a magnetic discharge by the induction of a current on itself in a long spiral or helical wire. These progressive steps in magnetic science gained for him an extended reputation, and soon after the publication of the last experiment in Silliman's 'American Journal of Science' Henry was elected professor of natural philosophy in Princeton College. The discovery of the spiral or helical conductor suggested to him further experiments, and his extended researches and their results were announced by him in a paper published 1834, under the title 'On the Influence of a Spiral Conductor in Increasing the Intensity of Electricity from a Galvanic Arrangement of a Single Pair.' He supplemented these discoveries by many others, and by his experiments produced electrical combinations which were undoubtedly precursors of later relay and receiving magnets, while his demonstration of the conditions and range of induction from electrical currents, and the successive orders of induction in the passage of frictional electricity, as well as his discovery of the oscillatory nature of electricity, paved the way for that great scientific and practical resolution which was to consummate by the genius of Morse and his confrères.

In 1846 Henry was called to a new sphere of activity, in which he exhibited his usual zeal and enthusiasm. The Smithsonian Institution had just come into existence, and during the formative period of the great museum, he was appointed to be its secretary. The office did not so far engross his attention as to make him neglectful of practical work in science. He found time to investigate the acoustics of public buildings, meteorological changes of the atmosphere and methods for telegraphic transmission of meteorological observation from all points of the continent. From 1868 up to his death he was president of the National Academy of Sciences, and of the Philosophical Society of Washington from 1871, when it was first organized.

HENRY, Matthew, English Nonconformist clergyman: b. Broadoak, Flintshire, Wales, 18 Oct. 1662; d. Nantwich, Cheshire, 22 June 1714. In 1686, having qualified himself for the ministry, he began to preach; and in the succeeding year he was settled as pastor to a congregation at Chester, and continued to discharge the duties of his office for 25 years, when he removed to Hackney, London, where his clerical labors were still more extended. Besides his greatest work, 'Expositions on the Bible' (1710), he was the author of 'A Discourse on Schism'; 'A Scripture Catechism'; 'Family Hymns,' etc.

HENRY, O. Nom de plume of William Sydney Porter (q.v.).

HENRY, Patrick, American orator and statesman: b. 29 May 1736, in Hanover County, Va., within a few miles of the birthplace of Henry Clay; d. 6 June 1799, in Charlotte County, Va. His father, John Henry, was a well-educated Scotchman, presiding judge of the Hanover court. He was a cousin of William Robertson, author of the 'History of the Emperor Charles the Fifth.' Another relative

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of his was Henry Brougham, the radical Scotch writer, who became lord chancellor of England. Of Patrick Henry's mother, «a portly, handsome dame,» a pleasing portrait is left us by William Byrd, of Westover, the genial littérateur of colonial Virginia.

The schools were poor in his neighborhood, and Patrick seems to have profited little by them. From his uncle, the rector of the parish, he gained a rudimentary knowledge of the classics and mathematics. He was a frolicsome and vagrant youth, fond of hunting and frontier life in general. At 18 years of age, and without money or employment, he married Sarah Shelton, a poor girl of the neighborhood. He kept a store and failed; he tried farming, and failed; then he returned to the store, only to fail again. He now turned to law, and spent a few weeks in reading upon that subject. Having received his license, he began to practise in his native county, while he assisted in the tavern kept by his father-in-law.

In 1763 Henry singled himself out as a born orator by his impassioned plea in «The Parsons' Cause.» The king had annulled a statute of the Virginia burgesses, which compelled the clergy to accept the depreciated currency of the colony in payment of their annual salaries, in lieu of 16,000 pounds of tobacco as theretofore, a product which was then selling at a high price. Henry startled the court and the countryside by asserting «that a king, by annuling or disallowing acts of so salutary a nature, from being the father of his people, degenerates into a tyrant, and forfeits all right to his subjects' obedience.» Henry's utterance on this occasion was in keeping with the bold address, two years previous, of James Otis, who declared that the tyranny lurking in general search warrants had «cost one king of England his head and another his throne.»

Henry became a member of the House of Burgesses in May 1765, just at the time of the arrival of the Stamp Act. Unabashed by his rustic appearance and inexperience in legislative matters, he brought forward a series of resolutions to the effect «that the general assembly of this colony have the only sole and exclusive right and power to lay taxes.» In the bloody debate which followed he was «opposed by Randolph, Bland, Pendleton, Nicholas, Wythe, and all the old members, whose influence in the House till then had been unbroken,» so we learn from Jefferson, then a college student, who was present at the session of the burgesses. In pleading the injustice of the Stamp Act, Henry used the famous words: «Cæsar had his Brutus; Charles the First, his Cromwell; and George the Third [‹Treason!› shouted the Speaker. ‹Treason,› ‹treason,› echoed others. After a moment's pause, the orator completed the interrupted sentence in a manner that showed no less defiance than adroitness] and George the Third may profit by their example. If this be treason, make the most of it.» As the royal governor of Massachusetts wrote the ministry: «The Virginia resolves proved an alarm bell to the disaffected.» By his intrepidity, his oratory, and his intuition, at once patriotic and prophetic, Patrick Henry became henceforth the protagonist of the colonial cause, sharing with Otis, Gadsden, and Samuel Adams the high honor of launching the American Revolution.

Henry represented Virginia in the first colonial Congress, which met at Philadelphia 5 Sept. 1774, when he gave final expression to the feeling of nationality: «The distinctions between Virginians, Pennsylvanians, New Yorkers, and New Englanders are no more. I am not a Virginian, but an American.» With this speech compare Christopher Gadsden's remark nine years before at the Stamp Act congress in New York: «There ought to be no New England men, no New Yorkers, known on the continent, but all of us Americans.»

On 23 March 1775, Henry, as a member of the second Virginia convention, which met in Saint John's Church, Richmond, moved that the colony be armed, and again electrified the patriots with his eloquence in support of this radical measure by the oft-quoted utterance: «Gentlemen may cry peace! peace! — but there is no peace! The war is actually begun! The next gale that sweeps from the North will bring to our ears the clash of resounding arms! Our brethren are already in the field! . . . Is life so dear, or peace so sweet, as to be purchased at the price of chains and slavery? Forbid it, Almighty God! I know not what course others may take; but as for me, give me liberty, or give me death!» Col. Edward Carrington, listening at a window in the east end of the church, was so transported by the eloquence of Henry, that he exclaimed, «Let me be buried at this spot,» a wish that was respected at his death in 1810. Such was the universal testimony of those present as to the overmastering effect of Henry's speech at that crisis.

On 5 Aug. 1775, Henry was made commander-in-chief of the Virginia troops. In May of that year he had made a dash against Lord Dunmore, on account of the governor's secret seizure of some powder belonging to the colony. Deeming himself slighted by the Committee of Public Safety, which acted during the interim as the executive of Virginia, Henry, with some heat, threw up his military commission, 28 Feb. 1776.

Fortunate was it for the colonial cause that Henry was again at liberty to exert his forensic powers in the councils of the State. Representing Hanover County in the convention which met at Williamsburg 6 May 1776, he contributed greatly to the constructive work of that celebrated body, notably the motion for a declaration of American independence and the framing of a constitution for Virginia. Among the convention papers in the State Library at Richmond were found three endorsed by the clerk, «Rough Resolutions. Independence.» William Wirt Henry, after minute comparison of the handwriting of these, concluded that the first was penned by Patrick Henry; the second by Meriwether Smith; and the third by Edmund Pendleton; and that the resolution actually introduced by Nelson was the one written by Henry. On the other hand, Edmund Randolph, who was a member of the convention, says that the resolution declaring for independence «was drawn by Pendleton, was offered in convention by Nelson, and was advocated on the floor by Henry.»

On 29 June 1776, the natal day of the commonwealth of Virginia, Patrick Henry was elected governor, took the oath of office 5 July, and served for three annual terms in succession. As governor he commissioned, on 2 Jan. 1778, Col. George Rogers Clark to enlist seven companies of men for the expedition against the British garrisons in the Northwest Territory. After leaving the executive office, Henry settled in Henry County, on an estate of about 10,000 acres, called Leatherwood, where he lived until he became governor for the fourth time, on 30 Nov. 1784. In the Virginia convention of 1788, which was called to ratify the Constitution of the United States, Henry led the opposition on the ground that such a federal government encroached too far upon the rights of the several States. While the arguments of Madison and the influence of Washington happily prevailed on that critical occasion, Henry was a chief agent in securing the amendments which constitute a bill of rights in the national instrument. His objection to the Constitution was stated concisely in his first speech before the convention: «That this is a consolidated government is demonstrably clear; and the danger of such a government is, to my mind, very striking. . . . Who authorized them (the framers) to speak the language of *we the people*, instead of *we the States?* States are the characteristics and the soul of a confederation. If the States be not the agents of this compact, it must be one great, consolidated, national government of the people of all the States.» Such was his clear discernment of the real nature of the government established by the Constitution of the United States.

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HENRY, Thomas William, Australian journalist and literary man: b. Sydney, November 1862. He has been continuously in newspaper work since 1878. From 1899 to 1903 he was editor of the *Herald;* after which he became editor of the *Sunday Morning Herald.* His published works include 'Fortunate Days' (1890); 'The Girrel at Birrells' (London 1896); 'A Station Courtship' (1898). Most of his best work is buried in magazines and newspapers. He is considered one of the best editorial writers in Australia.

HENRY, William Arnon, American educator: b. Norwalk, Ohio, 16 June 1850. He obtained his early education in the Holbrook Normal School at Lebanon, Ohio; studied at Ohio Wesleyan University from 1867–69, and at Cornell University from 1876–80, receiving the degree of B. S. Agr. He was appointed professor of botany and agriculture in the University of Wisconsin in 1881, professor of agriculture in 1883, director of the agricultural experiment station in 1887, and in 1891 was made Dean of the College of Agriculture, serving as dean and director until June 1907, when he retired owing to ill health, with the title professor emeritus of agriculture. He wrote 'Handbook on Northern Wisconsin' (1895); 'Feeds and Feeding' (1898; 16th ed., 1916).

HENRY, William Wirt, American historian and lawyer: b. Red Hill, Va., 14 Feb. 1831; d. 5 Dec. 1900. He was educated at the University of Virginia, and took up the practice of law, later being elected to the legislature for four terms. He preferred, however, historical research to his law practise, and spent much of his time in that pursuit. He was president of the American Historical Association and of the Virginia Historical Society. He is chiefly noted for his 'Life, Correspondence, and Speeches of Patrick Henry' (3 vols., 1890–91).

HENRY DOCUMENTS, 26 letters of 1809 between John Henry and several British officials — Sir James H. Craig, governor of British North America, his secretary Ryland, and the English foreign secretary Lord Liverpool, with related papers. Tempted by the hostility of the New England Federalists to the Embargo (q.v.), and the threats of secession by the extremists, Craig sent the adventurer Henry in January 1809 to sound the people as to reunion with Great Britain. Henry remained till June, and sent back the most extravagant reports of the secession feeling, but the British ministry not paying him as he thought fitting, he sold the copies of the letters and other documents to the United States government in February 1812 for $50,000. Madison used them to hurry forward the War of 1812, by sending them to Congress on March 9 with a special message, in which he accused Great Britain of attempting to dismember the Union by intrigue and annex the North to itself. So far as the New Englanders were concerned, however, the papers contained nothing incriminatory of secession movements.

HENRY MOUNTAINS. A group of mountains in the eastern part of Garfield County, Utah, on the west side of the upper part of Grand Canyon of Colorado River. It is about 40 miles long. The principal peaks are mounts Ellen, 11,485 feet, Pennell, 11,330 feet, Hillers, 10,650 feet, Ellsworth, 8,150 feet and Holmes, 7,950 feet. The adjoining area of the High Plateaus ranges in altitude from 4,000 to 6,000 feet. They are noted examples of the form of igneous intrusion known as laccoliths, the mountains consisting of lens-shaped masses of trachyte included in the Cretaceous and Triassic sandstones. Consult Gilbert, G. K., 'Geology of the Henry Mountains' (United States Geological and Geographical Survey of Rocky Mountain Region, Washington 1880).

HENRY PHIPPS INSTITUTE, The, for the study, treatment and prevention of tuberculosis, was established in 1903 by Mr. Henry Phipps, of New York, at Third and Pine Streets, Philadelphia. The situation was chosen as being in a section of the city in which tuberculosis was most prevalent, and was made possible by a special law permitting the establishment of the Hospital within the city limits. In February 1910, Mr. Phipps transferred the Institute to the University of Pennsylvania, having previously engaged to erect an appropriate permanent building for its accommodation upon grounds gradually acquired with this in view. The new building, located at Seventh and Lombard streets, was completed in May 1913. It is a beautiful and commodious edifice and embodies the most modern ideas of hospital, sanatorium and laboratory construction. The Institute is the first fully organized and equipped institution of the kind with university connection. An entire reorganization of the plan of work has been made by the University. The work is divided into distinct fields of activity, represented by two corresponding departments, the laboratory or research department, and the clinical and sociological department, each under its special director. An advisory council of 14 members has been selected, composed of the most distinguished men of the country in the lines of work carried on by this Institute, who visit the institution at least once each year. On account of its connection with the University, the Institute offers facilities for study to the students of the University of Pennsylvania, especially those of the Medical School. Both by visits to the institution and through the publication of the results of its investigations and research, the Institute has proven valuable both to students and physicians throughout the country interested in this special work.

HENSCHEL, hĕn'shĕl, Sir **George**, English composer and concert singer: b. Breslau, 18 Feb. 1850. He began his musical education under the pianist Moscheles, the contrapuntist Richter, and the vocal teacher Gosse in the Conservatory at Leipzig. In 1870 he sang with great success at the Beethoven celebration at Weimar, and toward the end of the same year went to Berlin to complete his studies in musical science and vocalization. He met with a brilliant reception in his professional tour through Cologne, Düsseldorf, and the lower Rhine provinces, and his fame spread over all Germany, Austria, Holland and Russia (1874-77). He was received with immense applause in London, and crossing the Atlantic was appointed musical director in Boston (1883-85); when he returned to London and became teacher of singing in the Royal College of Music (1886-88). He made England his permanent home, and in 1890 was legally naturalized. He was knighted in 1914 by George V. He wrote among his numerous compositions many songs, operas, chamber music and duets, such as 'Wanderlieder'; 'Duette in Kanonform,' 'Serbisches Liederspiel'; 'Stabat Mater' (1894); 'Music to Hamlet' (1892); and the volume 'Personal Recollections of Johannes Brahms,' etc. He married in 1881 Lilian Jane Bailey (d. 1901), a well-known American singer.

HENSLEY, Sophia Almon, American lecturer and author: b. Nova Scotia, 31 May 1866. She studied in England and Paris, and moved to New York in 1889. She has been interested in the study of social problems and actively identified with the work of the «Mother's Congress.» She has served as president of the Society for the Study of Life in New York City and as vice-president of the New York City Mothers' Club, and lectures frequently. She is author of 'Woman's Love-Letters' and 'Souls.'

HENSON, Herbert Hensley, English Anglican clergyman: b. London, 8 Nov. 1863. He graduated at Oxford and elected fellow of All Souls College in that university 1884. He was head of the Oxford House at Bethnal Green, 1887-88, canon of Westminster Abbey and rector of Saint Margaret's 1900-12; and Dean of Durham since 1912. He has attracted wide attention as a fresh and powerful preacher by his utterances on topics of social and political interest, and among his published works may be noted 'Light and Leaven' (1897); 'Cross Bench Views of Current Church Questions' (1902); 'Preaching to the Times' (1903); 'Christ and the Nation' (1908); 'The Liberty of Prophesying' (1909); 'Westminster Sermons' (1910); 'The Creed in the Pulpit' (1912); 'War-Time Sermons' (1915); 'Robertson of Brighton, 1816-53' (1916).

HENSON, Josiah, American negro slave and clergyman: b. Port Tobacco, Md., 1787; d. 1883. His early life was one of great hardship, but he finally escaped to Canada (1828), where he became a Methodist clergyman with a charge at Dresden, Bothwell County, Ontario. He also lectured in the United States. Upon the story of his slave career was based the character of Uncle Tom in Harriet Beecher Stowe's 'Uncle Tom's Cabin' (1852).

HENTY, George Alfred, English writer of novels and stories for boys: b. Trumpington, Cambridgeshire, 8 Dec. 1832; d. Weymouth, Dorsetshire, 16 Nov. 1902. He was educated at Westminster and Cambridge; he went to the Crimea during the war with Russia, and served there in the purveyor's department of the army. Soon afterward he went to Italv to organize the hospitals of the Italian legion. As special correspondent of the *Standard* newspaper he went through the Austro-Italian, Franco-Prussian and Turco-Servian, Abyssinian, Ashanti campaigns, besides accompanying Garibaldi in the Tyrol. He described two of these campaigns in the works 'The March to Magdala' (1868) and 'The March to Coomassie' (1874). He wrote eight novels, among which are 'A Woman of the Commune' (1895); 'The Queen's Cup' (1897); and 'Colonel Thorndyke's Secret' (1898); but he is much more widely known as the author of a large number of stimulating stories of adventure for boys, many of them based on famous historical events. Among these are 'The Young Franc-Tireurs' (1871); 'The Young Buglers,' a tale of the Peninsular War (1879); 'In Times of Peril,' a tale of India (1881); 'Under Drake's Flag' (1882); 'The Lion of the North' (1885), a story of Gustavus Adolphus; 'With Lee in Virginia' (1889); 'By Pike and Dyke' (1889), a story of the Dutch War of Independence; 'In the Irish Brigade' (1900); and 'Out with Garibaldi' (1900); 'With Roberts to Pretoria' (1902).

HEPATICA, a genus of plants, liver-leaf, of the crowfoot family (*Ranunculaceæ*), closely related to *Anemone*. The best-known species is *H. hepatica*, found wild throughout eastern North America as well as in Europe in woods, and widely cultivated for its attractive and fragrant star-like blue, white, or purple-red flowers, which open in early spring. It is, indeed, one of the earliest of American spring flowers. Sometimes even under the snow its buds, well wrapped up in a warm down, lie upon the broad, furry, liver-shaped leaves, awaiting the first warmth to induce them to open. In the southern Alleghanies its leaves are dried and steeped into a medicinal tea. A more southern species is *H. acuta*.

HEPBURN vs. GRISWOLD, 1869: the great case in which the Supreme Court of the United States decided that the government had no power to make its own notes legal tender; reversed through a change in the constitution of the court in Knox *v.* Lee and Juilliard *v.* Greenman. Mrs. Hepburn of Kentucky had given Henry Griswold a note for 11,250 «dollars,» payable 20 Feb. 1862; it was not paid when due, and five days subsequently the government passed the act authorizing $150,000,000 in notes (see Greenbacks), receivable for public and private debts. In 1864 Griswold brought suit in the chancery court of Louisville for principal and interest; $12,270 in greenbacks was tendered in settlement, but refused, on the claim that the act did not extend to debts contracted before its passage. The court decided for Mrs. Hepburn; Griswold carried the case to the Kentucky Court of Appeals, which reversed the decision; Mrs. Hepburn carried it to the Supreme Court, which on account of the far-reaching importance of the case, and at the request of the attorney-general, laid it over till 1868, when it was reargued, and finally decided in the December term 1869. Chief Justice Chase, for five justices against three, decided that the act extended to all debts, contracted as well before as after its passage, and that the question therefore must be whether the government had the power to make anything but coin a legal tender; that it could not do so, under the Constitution, because at the time of its adoption no money but gold and silver was recognized; that as paper money never rose above coin and almost always fell below it, each particle of depreciation was so much abstracted from the value understood by the parties to the contract, and was therefore an unlawful deprivation of private property; that the power of Congress to use "necessary means" to carry out its power of making war did not convey this right, because this was no more a special means of carrying out war powers than any other powers, and would enable it to issue bills of credit and make them legal tender just as much in the post office business or the patent business as the war. The minority admitted that it was so impairing the obligation of contracts, but asserted that Congress was given the power to do so; and this is now law. See Legal-Tender Cases.

HEPHÆSTUS, hĕ-fĕs'tus, a god of the ancient Greeks, identified by the Romans with their Vulcanus. He presided over fire, and was the patron of all artists who worked in iron and metals. He was the son of Zeus (Jupiter) and Hera (Juno). Homer says that his mother was so disgusted with the deformities of her son, that she threw him into the sea as soon as born, where he remained for nine years. He afterward returned, but for taking the part of his mother on one occasion against Zeus was thrown down by the latter a second time. He was a whole day in passing from heaven to earth, and fell in the island of Lemnos. He broke his leg by the fall, and ever after remained lame of one foot. He fixed his residence in Lemnos, where he built himself a palace, and raised forges to work metals. The Cyclopes of Sicily were his ministers and attendants; and with him they fabricated not only the thunderbolts of Zeus, but also arms for the gods and the most celebrated heroes. His forges were supposed to be under Mount Ætna, in the island of Sicily, as well as in every part of the earth where there were volcanoes. Aphrodite (Venus) was the wife of Hephæstus. Her infidelity is well known. Her amours with Ares (Mars) were discovered by Phœbus, and exposed to the gods by her own husband. He appears on some monuments with a long beard, disheveled hair, half naked, and a small round cap on his head, while he holds a hammer and pincers in his hand. See Greek Gods.

HEPTAMERON, The. The 'Heptameron' of Marguerite, sister of François I, variously called Marguerite d'Angoulême, Marguerite de Valois, or Marguerite de Navarre, is a collection of stories modeled on the 'Decameron' of Boccaccio. A company of travelers, five gentlemen and five ladies, on their way home from Cauterets, in the Pyrenees, are overtaken by a sudden storm and flood, and take refuge in a hospitable monastery till the impassable roads may be repaired. To while away the time, after giving the morning to hearing mass and the reading of Holy Writ, they pass the afternoon in telling stories that take us very far from the atmosphere of such edifying exercises. Each person tells a story each day. Apparently it was Marguerite's plan that 10 days should be passed thus, as in the Decameron. But the death of her brother interrupted her labors, and but 72 stories had been finished at her death, bringing the seventh day to an end, but only beginning the eighth; hence the name 'Heptameron.' Love is the invariable theme, but in ever varying guise, from gross appetite to fine and pure devotion. The tone is mainly that of gay and frank sensuality familiar to the Renaissance, but there is not a little fine feeling and delicate sentiment, and we may detect a tendency to look beyond the incident and the situation to the psychology and the moral quality of the actors that foreshadows the later development of fiction. A very interesting feature of the Heptameron is the brief comments of the company after each tale, in which, though quite divergent views of love are represented, we can discern Marguerite's own high ideal of womanly virtue and manly courtesy. The stories were published first in 1558 under the title 'Histoire des amanz fortunez,' but in incomplete form, and, still incomplete, under their present title in 1559. The edition of F. Frank (3 vols., 1879) is considered the best. There are numerous translations in English.

Arthur G. Canfield.

HEPTARCHY, seven Anglo-Saxon kingdoms into which England was at one time or other supposed to be divided, although the kingdoms were founded at different times, and at no one time were they all independent monarchies together. In 827 King Egbert of Wessex united them into one kingdom, and claimed the title king of England. See England.

HEPTASOPHS, Improved Order of, a benefit society, organized in 1878 as an independent branch of the Order of Heptasophs (q.v.). At the time of secession the Heptasophs had not adopted the benefit system. The constitution and ceremonies are identical with those of the parent order. At the close of 1910 it had 1,102 conclaves, a membership of 74,656, and since its organization had disbursed in benefits nearly $17,000,000.

HEPTASOPHS, Order of, a benevolent society in the United States founded in New Orleans 1852 by Alexander Leonard Saunders and other Freemasons, originally called "The Seven Wise Men." The ritual of its ceremonial is elaborate; the membership of each chapter is seven, or a multiple of that number. In 1872 the adoption of a death benefit system was agitated and the discussion led to the secession in 1878 of the Zeta Conclave of Baltimore, which organized the Improved Order of Heptasophs (q.v.). In 1880 the Order of Heptasophs adopted the benefit system. Members must be white males and profess a belief in the Supreme Being. Their number in 18 States amounts to about 4,000.

HEPWORTH, George Hughes, American clergyman, journalist and author: b. Boston, 4 Feb. 1833; d. 7 June 1902. He was brought up a Unitarian and after leaving the Harvard Divinity School held Unitarian pastorates at Nantucket, Boston and New York. He advocated preaching in theatres and conducted theatre meetings in various cities. Being not wholly at ease in the Unitarian denomination, he entered the Congregationalist ministry in 1872. He subsequently quitted the ministry and became attached to the editorial staff of the New York *Herald.* He published 'The Whip, Hoe, and Sword' (1864); 'The Criminal, the Crime, the Penalty' (1865); 'Starboard and Port' (1876), record of a yacht cruise; 'Hiram Golf's Religion'; 'Through Armenia on Horseback' (1899). Consult Ward, 'George H. Hepworth; the Story of his Life' (1903).

HERA, hē'rā or -rē, a mythological goddess of the Greek pantheon, identified by the Romans with their Juno, the sister and wife of Zeus (Jupiter), and daughter of Kronos (Saturn) and Rhea (Cybele). The poets represent Zeus as a faithless husband and Hera as a violent, jealous and vindictive wife. She was worshipped in all Greece, but her principal seats were at Argos and Samos. The companions of Hera were the Graces and Hours. Iris, a personification of the rainbow, which seems to stretch from heaven to earth, was her messenger. Her usual attribute is a royal diadem. The temples built in her honor were called Heræa. The principal one was at Argos, which city was considered to be especially under her protection. She is represented by Homer as taking the part of the Greeks in the Trojan War, being actuated by revenge for the slight passed on her by the Trojan Paris, who gave the golden apple inscribed "To the Fairest" not to her, but to Aphrodite. See GREEK GODS.

HERACLES. See HERCULES.

HERACLITUS, Greek philosopher: b. Ephesus, who flourished about 513 B.C. He traveled in different countries, particularly in Africa. On his return to Ephesus he was offered the chief magistracy, but refused it. He left a work on nature, in which he treats also of religion and politics. Some fragments only of this work remain. He is considered as belonging generally to the Ionic school of philosophers, though he differed from it in important particulars. He considered fire as the first principle of all things, describing it as an ethereal substance, "self-kindled and self-extinguished," from which the world is evolved (not made) by a natural operation. It is also a rational principle and the source of the human soul. Phenomena exist in a constant state of flux, always tending to assume new forms, and finally returning again to their source.

HERACLIUS, hĕr-a-klī'ŭs, Roman emperor of the East, from 610 to 641: b. Cappadocia, about 575 A.D. He was the son of Heraclius, exarch of Africa, who had gained great renown by his victories over the Persians. The elder Heraclius of the East was applied to by a powerful body of insurgents to claim the throne for himself. This he declined, but sent his son Heraclius to do so. Heraclius the younger therefore ascended the throne, and though he undoubtedly possessed considerable talents, the Roman empire in the East was tottering to its fall and nothing he was able to do could save it. Before his death Mohammed had carried his victorious arms on every side, and Syria, Palestine, Mesopotamia and Egypt had fallen under the dominion of the caliphs. He was permitted, however, to die in peace and to transmit the succession to his son, who mounted the throne under the title of Constantine III.

HERALDIC CROSSES. See CROSSES AND CRUCIFIXES.

HERALDRY is the whole group of ceremonial duties discharged by the heralds of a court, an army, a great noble or the like, with the assistance of their pursuivants and under the direction of the Earl Marshal, King-at-Arms, the College of Arms or other chief of the institution. These duties are generally divisible into heraldry proper or the business of regulating ceremonial occasions, such as coronations, marriages among princes, proclamations of important events and the like; and armory, or the art of quasi-science of armorial bearings. In the first of these divisions but little remains of any interest at the present day, for only in Great Britain is the herald of any consequence. There, however, he still has some direction, as at the eventful proclamation of 1 May 1876, when the Queen of Great Britain assumed the title of Empress of India. In the second branch of the subject, the order and marshaling of arms, the Germans are perhaps at the head of modern writers, though the English and Scottish treatises on the subject are more numerous and more widely used. The Germans' thoroughness of investigation has marked their treatment of this subject, which is eminently a branch of mediæval and subsequent history serving to elucidate genealogical research.

Modern heraldry is no older than the tournaments of the Middle Ages. No linking evidences of the science occur during the Dark Ages, although badges and emblems are found on shields and helmets discovered in the ruins of antiquity, while in Biblical times the men of Israel were directed to pitch their tents, every man by his own camp and standard with the ensigns of his father's house. Greek and Roman writers describe devices on shields and helmets; the golden eagle on the shields of the kings of Media; the standards and brilliantly-colored shields borne by the ancient Germans in battle. The office of herald is as ancient as that of priesthood. Spartans, Greeks and Romans had heralds, the Roman officers being divided into three classes: *caduceatores,* heralds of peace; *fetiales,* heralds of war and peace; and *præcones,* judicial criers or messengers. The *caduceator* on a mission carried a wand of laurel or olive (*caduceus,* q.v.), as a symbol of his office and for his security. The *fetiales* are thought to have had a college of 20 members founded by Numa, who formulated the procedure and ceremonies connected with the declaration of war and the making of treaties. The *præcones* were employed to proclaim matters of public interest to the people at religious ceremonies, in the *comitia*, at public sales, judicial trials, in the senate, on the publication of laws which they read, at funerals, at games, in the army when a general wished to address his men, at executions and at all public meetings. The heralds of the Middle Ages had duties which in part resembled those of the heralds of antiquity. Thus, they carried messages of peace and of defiance, and yet even in the earlier years of feudality their office was an inferior one, they being replaced by ambassadors, diplomats almost in the modern sense, statesmen in whose suite the heralds and pursuivants went to the foreign court. So it was that the chief duty of the herald came to be the care of armories.

The first known tomb or monument with escutcheons in the period of modern history is stated to be the 11th century tomb in the church of Saint Emmeran at Ratisbon, where are the bearings of Varmond, a count of Vasserburg; but this may be a later addition. Another very old specimen and certainly genuine is the shield at Le Mans of Geoffrey Plantagenet, who died in 1150. The use of coats of arms seems to have first become general in the 12th century. Rolls of arms in England are extant in the reigns of Henry III, Edward I and Edward II. Surcoats displayed armorial bearings in the reign of Henry III. The Roll of Caerlaverock, a poem in Norman-French, contains the names and armorial bearings of the knights and barons who attended Edward I at the siege of the Castle of Caerlaverock, Dumfriesshire in 1300 and exhibits heraldry already in a developed form. On coins also, no armorial ensigns are found till the 13th century; but then both coins and the seals of nobles and monasteries display them; the use of arms on the Great Seal of England was introduced by Richard I.

The study of armory became essential when at mediæval tournaments aged knights were appointed, whose duties were to act as arbiters and to pass judgment on coats of arms and the right of knighthood. Whenever a new knight appeared at a tournament, the herald had to *blasen* — that is to blow — the trumpet and proclaim and explain the bearing of his shield or coat of arms. Hence to blason (*blasen*) came to mean, to describe and explain a display of bearings. The heralds were also the chroniclers of the times and were present on all occasions of public ceremony. In France the first herald — *roi-d'armes* — was crowned and consecrated with religious ceremonies, and was called *Montjoie*, from the war-cry of the French royal armies. The heralds were united in associations and their duties formed a branch of science which was communicated only to the members. If any person pretended to the character of a herald, who on examination was found not to belong to the corporation, he was driven away with insults and frequently with violence. The heralds in modern courts are masters of ceremonies. In England there are now three kings at arms; the highest is the *Garter king at arms;* the second, known as *Clarencieux,* is for the southern counties; the third, styled *Norroy,* for the northern provinces. These three kings at arms with six subordinate heralds and four pursuivants form, under the presidency of the Earl Marshal, always the Duke of Norfolk, the herald's college or herald's office, established in 1483. The use of arms by private persons in the British Isles was forbidden by proclamation in the reign of Henry V. All persons who had not borne arms at Agincourt were prohibited from assuming them unless by hereditary descent or with the sanction of the constituted authorities. Periodical circuits called visitations were held afterwards by the provincial heralds to take cognizance of the arms, pedigrees and marriage of such as were entitled to the use of armorial bearings. These visitations continued till about the end of the 17th century; their records, many of which are preserved in the British Museum and elsewhere, contain much genealogical information and are still consulted for evidence of the hereditary right to bear arms.

The practice of *blazoning the arms* is frequently referred to in the poetry of the Troubadours of the 12th and 13th centuries. Those knights who asserted a right to appear at tournaments did so by the blazoning of their arms, and from the Germans this custom was transmitted to the French, for tournaments were held in Germany before they became general in France. The French, however, carried to far greater perfection the tournament, and the blazon of heraldry connected with it, as they did the whole system of chivalry; the French language prevailing at the court of England after the Norman Conquest, pure French expressions came to be preserved in British heraldry. German heraldry, on the contrary, contains almost pure German expressions.

The whole display of any person's arms is called an *achievement,* also spelled atchievement. Only the escutcheon, however, is of vital importance. This is the broad surface on which the bearings are *charged.* It is always assumed to be a shield in the case of a man not an ecclesiastic; but churchmen's arms are charged upon an oval or other architectural form, a sort of cartouche, and women's bearings are charged upon a lozenge set vertically. The arms of husband and wife, however, may be charged on a shield divided vertically in the middle, and are then said to be dimidiated or impaled; thus we might say that such an escutcheon bears the arms of Smith impaling the arms of Jones — Smith and Jones standing for the two spouses. It is rare to charge the wife's arms unless she was an heiress, that is to say a lady without brothers, and therefore having the parental arms by right. These rules, however, are those of Great Britain; they differ widely in other countries.

A single escutcheon may be complete with one simple partition. Thus, a horizontal line divides the chief or top of the field at one third of its height from the remainder of the field. If that chief is, say, of gold, while the rest of the field is blue, that by itself makes a very perfect and honorable heraldic blazon. The chief is one of the honorable ordinaries, and others are almost as simple. They are the pale, a vertical stripe in the middle of the shield and one third of its width; the fess, a horizontal stripe; the bend, which goes diagonally from the left hand upper corner to the right hand lower part, ending against the rounded border of the shield; the bend sinister, which is a bend turned the other way (but see below, dexter and sinister); the chevron, which is a pair of stripes meeting in the middle, forming a figure like the letter A without the cross-bar; the cross, the two arms of which are usually of one quarter the width of the escutcheon; and the saltire, which is a diagonal cross. A shield upon which there is any one of these honorable ordinaries and nothing else, is one of dignity. In general the simpler shields are the older; thus the old family Erskine, with a black pale on a silver field, or the family of Beauchamp with a gold fess on a red field, occupy the most enviable position in having such a plain escutcheon. There are ordinaries of the second rank, such as the quarter or canton, the orle, and besides these there are very many bearings in common use, especially those which are diminutives of the honorable ordinaries. Thus, the pallett is a smaller pale, and the shield of Aragon has four red palletts side by side on a gold ground. These again may be used as charges upon the greater ordinaries. Thus, the escutcheon of Loreyn bears a blue bend sinister on a gold field and the bend itself is charged with three golden six-pointed stars. That also is a simple and presumably ancient armory.

In describing the escutcheon the side on the left of the spectator is called the dexter and that on his right is called the sinister side; that is because the shield, when carried on the arm with the man-at-arms behind it would be to him so disposed. The escutcheon is supposed to be divided into a certain number of imaginary points or divisions for the fixing and placing of the bearings when they are described in words. When there are nine points, the three at the top following each other from the dexter to the sinister side are dexter chief, middle chief and sinister chief, and a similar nomenclature is used throughout. A modern and fuller arrangement is to give eleven points, the honor point interposed between the top horizontal row and the middle one; and the nombril point spaced between the middle row and the lowermost one. A small bearing as a mullet (a five-pointed star) may be located as being in the dexter chief or the like.

The main purpose of armory is to so present simple patches of vivid colors as to be recognized at a great distance. The tinctures used in Great Britain are seven — two metals, *or* and *argent* (gold and silver); five colors, *gules* (red); *azure* (blue); *sable* (black), *vert* (green), *purpure* (purple); though this last is very rare and green is not very common. There are also two furs, which are represented by curious conventional patterns supposed to represent the patchwork of small skins sewed together which make a garment or the lining of a garment. These furs are ermine and vair, but each has many curious variations known by different names. Thus «ermine» shows black tails on a white field, or in modern times a flowerlike pattern suggested by the real ermine; but erminois has the same pattern in black on a gold field.

Dimidiation and impaling, mentioned above, are varieties of the great general subject of marshaling. The more elaborate form of marshaling is to divide an escutcheon into quarters. Thus, the son of a married pair who have borne their arms impaled, may divide the escutcheon into four quarters and will put his father's arms on the first and fourth quarters (dexter chief and sinister base) and those of his mother on the second and third quarters. This quartering may be quartered again, and so on indefinitely. Thus, the escutcheon of the Prince of Wales during the reign of Queen Victoria (of him who became King Edward VII) is too elaborate to describe fully here. This is because his bearings as Duke of Rothsay, Lord of the Isles, Duke of Cornwall, Baron Renfrew, and the like were all charged together, so that the number of small subdivisions is remarkable. Now, there are different ways of charging these. Those which his escutcheon must bear are the royal arms of England differenced with the label of the heir apparent, which is a label of three points *argent*, and this escutcheon will bear in the middle a small shield with the arms of Saxony. Even in this the inescutcheon is out of place when we are considering his arms as heir to the Crown. It is held by many that the Prince of Wales should display two shields; the first as simple as possible, with only the quarters for England, Scotland and Ireland; while the second should display all his primary and secondary arms, including those of his wife, who, in the case assumed above, was the Princess Alexandra of Denmark. Again, a system is adopted by which a large shield bears those royal arms upon it, an inescutcheon with the secondary arms of Cornwall, Rothsay, Chester, Dublin, Lordship of the Isles, Carrick, Renfrew, Wales as a principality, and over all a small escutcheon of pretense charged with the arms of Saxony for Saxe-Coburg-Gotha. But even these do not include the arms of the Princess, his wife, which should rightly occupy the sinister side of the shield, while all the achievement described above should be charged upon the dexter side. It is evident, then, that a person whose family has formed many dignified alliances may have an indefinitely great number of quarterings. But let us take the escutcheon of a king of the House of Hanover, as George IV, and we shall find that the four quarters of the shield are charged in this way: the first quarter (dexter chief) in *gules*, bearing three lions *passant gardant*, and the fourth quarter (sinister base) exactly the same. These two quarters are England. The second quarter (sinister chief) is Scotland, a field *or* with a lion *rampant gules*, framed in a *bordure fleur-de-lisée*, also gules. The third quarter (dexter base) is Ireland, the Irish harp *or* on a ground *azure*. Upon this shield is set an inescutcheon, divided in a curious way into three parts, for Hanover, and having above it a royal crown. Upon this inescutcheon is still a second inescutcheon, very small, simply *gules* with a bearing *or*, which is supposed to stand for the imperial crown of Charlemagne this in commemoration of the electoral dignity of the sovereign of Hanover, who was called the Elector until after the Napoleonic wars. It is a rule never to place metal upon metal or color upon color. Thus, if your shield is argent, any bearing put upon it must be in one of the colors — never in *or*.

But there are several curious exceptions; as that of the Latin Kingdom of Jerusalem (which lasted only from 1099 to 1187, but which is perpetuated by the addition of its bearings to many private shields) was *argent*, a cross potent between four crosslets *or*. This means a large gold cross, at the end of each arm of which is a cross head like the handle of a crutch; and in the little corners left by the cross, four small Greek crosses; all these in gold on a silver ground.

No two persons should bear the same arms at the same time, therefore a distinction is made between the escutcheons of younger children. Even the heir may distinguish his bearings from his father's by a special mark, apart from the quartering described above. The term marks of cadency is used for these differences. Many varying plans have been followed, and one which has been much accepted is the label. This is a band with pendant strips hanging from it, usually three; and this is laid right upon the escutcheon near its head, and crosses it, partly concealing all the bearings. This label will be plain for the eldest son, differenced by a bearing like a crescent for a second son, a mullet for the third son, a martlet for the fourth son, and so on.

The practical functions of the herald developed into blazoning, historifying, passing judgment on, and marshaling coats of arms. Blazoning is the methodical description of a bearing. In the first place the shield is described according to its tinctures, figures and partitions. The other parts of a coat are then blazoned — the helm with its crest which are trumpet, wings and plumes, men and animals, or their members; then the wreath and its tinctures; after which the cornet, cap, etc.; finally the supporters, the mantling, the device or motto and other secondary addenda. To historify in heraldry is to explain the history of a coat of arms, its origin, and the changes it has undergone. If the herald is to explain a bearing historically, he must show that this figure is the proper emblem of the family or country. He derives, for instance, from historical sources the proof that the double-headed eagle of the German Empire was first introduced by Charlemagne (A.D. 802); and he records the privilege given to wear that eagle on a private escutcheon. So he shows that the three leopards (lions passant gardant) in the English arms were first derived in 1127 under Henry I from the Norman house. The marshaling of arms is especially important in the preparation of new escutcheons. In this matter, the herald either follows the orders of the sovereign, or he invents the coat, and makes the charges on the escutcheon according to his own judgment, or he composes a new escutcheon from several coats of arms.

When color is not used, a system of conventional drawing is substituted; thus, *argent* is left white, *or* is white with black dots, *azure* by horizontal black lines on white, *gules* by vertical black lines, *sable* by crossing black lines horizontal and vertical, *vert* by lines from the dexter chief to the sinister base, *purpure* by lines from the sinister chief to the dexter base. The furs have peculiar patterns and surfaces of their own.

The crest is the uppermost part of achievements of arms and is set above the escutcheon. It is called crest from the Latin word *crista*, which signifies a comb or tuft, such as many birds have upon their heads. Crests were anciently marks of honor, because they were worn only by heroes of valor and high rank that they might be the better distinguished in an engagement, and thereby rally their men if dispersed; or else they were of the nature of badges worn by all the followers of a chieftain and serving to identify them. They are at present considered as mere ornaments; and they may be assumed without authority; obviously they should not be used by women. Supporters are figures placed on each side of the shield and perhaps originated from the custom of pages in fantastic dresses guarding the achievements of arms of their masters while the latter were taking part in the exercises of the tournament. The scroll is an ornament usually placed below the shield and supporters, containing a motto or short sentence alluding to the crest, or to the bearing or to the bearer's name. The motto had its origin in the war cries of knights, though in some instances mottoes were borne differing from the war cry of the wearer. The badge does not belong to heraldry, though it may be a part of the heraldic achievement, used separately. The porcupine was the badge of Louis XII of France, and the salamander was chosen by Francis I when he came to the throne, but neither of these was included in the escutcheon or worn as a crest. The reader may consult Palliser, 'Historical Devices, Badges and War Cries' (London 1870). The most recent large and important book on heraldry in English is 'The Art of Heraldry,' by Arthur Charles Fox-Davies, which is based upon the 'Heraldischer Atlas' of H. G. Ströhl. An excellent book for persons who are making a serious study of the matter is Berry's 'Encyclopædia Heraldica,' in three volumes, n. d. (about 1820). The treatise on Heraldry by Woodward and Burnett (2 vols., 1892), is a very full and up-to-date manual. Smaller books are numerous. To name English ones alone Cussan's 'Handbook of Heraldry,' Planché's 'The Pursuivant at Arms,' Worthy's 'Practical Heraldry,' and especially Charles Boutell's two books, 'English Heraldry' (2d ed., 1871), and the very remarkable essay, 'Heraldry, Historical and Popular' (3d ed., 1864), now scarce, but nevertheless the most suggestive book that can be found.

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HERAT, hĕr-ät', Afghanistan, a city in the northwest near the Heri-Rud River, 550 miles west of Cabul, 66 miles south of the Russian railway terminal and 290 miles north of New Chaman, the British-Indian railway terminal. It is defended by a strong citadel. The caravansaries, public baths, and mosques are numerous. The trade, almost entirely in the hands of Hindus, is greatly favored by the situation of the town on the great thoroughfare from India westward. Herat was long the capital of the empire founded by Tamerlane, and was once much larger and more splendid than now. Its possession has been repeatedly contested among the peoples of central Asia. Its capture by Persia in 1856 led to a short war between Britain and Persia. As the key to Afghanistan near Persia and Russia, its strategic importance has often made it a scene of great military activity. Pop. 20,000.

HERAULT DE SECHELLES, sā'shĕl, **Marie Jean,** French revolutionist: b. Paris, 1760; d. there, 1794. He became imbued with the teachings of Diderot, but, after his election to the Legislative Assembly in 1791, being rather a philosopher than a revolutionist, he at first paid little attention to the radical element there. He soon, however, joined the extreme left, and later on supported Danton in the revolution of August and September 1792. He was a deputy from the department of Seine-et-Oise to the Convention of 1792 and voted for the king's death. He became a member of the committee of public safety, and as such gained the enmity of Robespierre, who claiming that he had betrayed certain secrets to the army of the Rhine, caused him to be arrested and executed. His best writings were published under the title 'Voyage à Montbard' (last ed. 1890).

HERB PARIS, a poisonous plant of the lily family (*Paris quadrifólia*), resembling and related to white hellebore (q.v.), the toxic principle of which is a specific alkaloid called paradin.

HERBARIUM, a collection of dried plants systematically arranged for study; it is sometimes called *hortus siccus,* "dry garden," and is an indispensable adjunct to the work of the systematic botanist. The most famous public herbaria are those of the Royal Botanic Gardens, Kew, London, the British Museum and the Royal Botanic Gardens, Berlin. Those in Paris, Leyden, Berlin, Brussels and Vienna are also very full and complete.

In the United States there are several large herbaria, namely, the Gray Herbarium of Harvard University, the Herbarium of the New York Botanical Garden, the United States National Herbarium at Washington, that at the Missouri Botanical Garden, Saint Louis, and the herbarium of the Field Museum of Natural History, Chicago. Many universities and colleges also possess large collections of plants. The first named contains a majority of the older types of American plants, and the national herbarium contains the material brought together by the government collectors and many of the most important collections of the early government surveys.

HERBART, Johann Friedrich, German philosopher: b. Oldenburg, 4 May 1776; d. Göttingen, 11 Aug. 1841. His career is evidence of the fact that at least some men may live peaceful lives in stormy times. A student at Jena under Fichte, a tutor in Switzerland, a docent at Göttingen in the theory of education, and after that a professor to the end at Göttingen, at Königsberg, and finally at Göttingen again — that is the story of his life. But if he took no part in the revolutionary tumults that afflicted his country, he at least became a leader in her intellectual contests. His metaphysics stands at the opposite pole from that of Hegel. His psychology laid the foundations for modern psychophysics and experimental psychology, while his pedagogics is still the source of much of our best educational theory and practice.

The turning point between Herbart and Hegel lies in the use to be made of the principle of contradiction. Herbart took the orthodox stand that what contradicts itself cannot be truly real or actual, whereas Hegel boldly incorporated the principle of contradiction as a stage in what might be called his dialectic of evolution, which follows the formula, thesis, antithesis, synthesis. The antithesis is the contradiction of the thesis, but only that the two may come together again in a higher synthesis. A familiar illustration is the relation of (1) being, (2) non-being and (3) becoming, in which the second is thought as the contradiction of the first, while the third is conceived as a higher synthesis of the first two, since becoming has elements both of being and of non-being. Herbart, however, rejects such reasoning as insufficient, and demands that philosophy shall accept the validity of the principle of contradiction, and honestly endeavor to remove the contradictions inherent in our everyday thought of the world. Such contradictions are encountered when we consider a thing and its attributes or the ego, which is both subject and object, or when we trace experience back to matter, in which the notions discrete and continuous are seen to be at variance. The effort to remove the contradictions leads Herbart back to a pre-Kantian method of speculation, for he holds himself ready to accept any sort of a presupposition, rational, or irrational, which promises to resolve the difficulty, even though the principle of explanation should forever resist demonstration as to its reality. In other words, we may assume anything to be true which clears up our thinking. But this is the method of Leibnitz, of Spinoza, and of many others antecedent to the time of Kant (q.v.). The fundamental form in which contradiction appears is that the simple is conceived as manifold. For example, the thing we call water is at the same time thought of as heavy, fluid, colorless, having the quality of quenching both fire and thirst, and as being capable of transformation from a liquid to a solid or to a vapor. The way to overcome this contradiction is to assume a plurality of simple beings, and to explain the manifold as appearance arising from their relations. These simple beings that underlie the phenomenal world are atoms, or monads, or as Herbart prefers to call them, *Reals*. They are conceived to be in mechanical interaction, and to give rise to the manifold we have in experience. Like the atoms of Democritus they are simple and alike in quality, but unlike the monads of Leibnitz they are not points of self-active force, containing an inherent principle of development. Why and how the *Reals* act and interact Herbart does not explain, not even how they get and exercise their one function of *Self-preservation*. The inability to explain these things which we most want to know is the penalty attached to this type of metaphysics. Yet it would be unfair to assume that no good results can come from even such pre-suppositions. *The Reals* are not spatial in the ordinary meaning of that term, for space and time as we know them are themselves phenomenal products, but they may be conceived to be in what Herbart calls *intelligible* space, in which the *Reals* exist in a state of partial or total interpenetration. Here they reciprocally «disturb» one another, a «self-preservation» resulting, which is a «state» of the *Real*. When the *Real* which is «disturbed» happens to be a soul, the disturbance, or the state of self-preservation, becomes an *idea*, which is the primary form of mental life. Psychology is, therefore, the science of these self-preservations of the soul-monad, which is like all *Reals* unknowable, but as Herbart thinks a necessary presupposition of our experience. Psychical life is the reciprocal tension of ideas. Consciousness depends upon the degree of this tension. The lowest degree of strength which an idea can have and still be actual marks the threshold of consciousness. If reduced below this degree it remains as «*impulse,*» and may rise again when freed from «*arrest.*» The soul monad has its seat in the brain and is in intimate interaction with a multitude of other *Reals*. Outwardly originating stimuli are conveyed to the brain by the nerves and reach the soul through the medium of the other *Reals* present. Since the idea is the primary form of mental life, feeling and volition must be explained through an examination of the inhibitory relations of the ideas. Pleasure arises when there is a furthering of mental movement, and pain when there is an arrest. Volition arises from desire, a state of feeling, which has a natural impulse to find satisfaction through action. Since mechanical action and reaction of the *Reals* is the source of ideas, it seems a natural conclusion that there may be a statics and mechanics of mental states. This led to Herbart's attempt to work out the calculus of ideas, thus opening the road for the modern quantitative study of mental phenomena, as seen in psychophysics and experimental psychology. Herbart claims to have founded psychology anew upon metaphysics, mathematics, and experience. The third of these bases is treated under the term *apperception,* which has important results for education.

Leibnitz, who introduced the term apperception, employed it in a double sense. Its first meaning is the original power of the mind to unify experiences originating in sensation; this is the sense in which Kant uses the term. The second meaning is the mental assimilation that takes place when we use knowledge already acquired to interpret new knowledge. It is natural that Herbart should emphasize the latter process, for though he could hardly deny the validity of the first form of apperception, yet so slight is the original equipment of the mind — merely the power of preserving itself against the encroachments of other *Reals* — that all the significance of its activity must be found in acquiring experience. This, it may be remarked, is the process most important to teachers, for they can help to supply and order experience, whereas they have no control whatever over the original constitution of the mind. Herbart sees in each new sensation a stimulus to ideas already possessed, an attractive force for the similar, a repelling one for the dissimilar. The new idea therefore at first holds the centre of consciousness, gathering about itself similar ideas, and repelling hostile ones already in consciousness or newly attracted to it by contrast. But this very domination of the new idea is in most cases the cause of its reduction to a subordinate place, for by bringing to consciousness a body of more deeply rooted related ideas, it enables the old to control the new by placing the new in its true relation to older and better ordered experience. In other words, the new is apperceived by the old. Herbart's theory, thus briefly stated, has been extended and freed from contradictions, by subsequent writers, notably Lazarus, Steinthal and Wundt (qq.v.).

All knowledge, feeling, desire and will, being explained by the various relations into which ideas may come, there is no room in Herbart's system for transcendental will, hence no ethical imperatives antecedent to those developed by experience. Ethics consequently becomes a branch of æsthetics, and ethical judgment is founded upon pleasurable or painful feelings as the case may be. The mind spontaneously approves some will relations and as spontaneously disapproves others. These basal relations refer to five fundamental aspects of conduct, two relating to the self as such, and the remaining three to the relations of the self to others. The first two are *Inner Freedom* (the feeling that arises from good conscience) and *Efficiency of Will* (the pleasure that is aroused by efficient action). The three other ideas are first *Good Will* (subjective attitude toward others), the second *Justice* (the legal basis of rights), and the third *Equity* (the demand that requital shall be adequate to deed).

Upon the basis of his psychology and ethics as above explained, Herbart built his educational structure. Since there is no source of character but experience, it is to experience, i.e., to organized knowledge or groups of ideas, that we must look for the development of character, which thus has its roots, not in a single department of knowledge as, e.g., that grounded in sacred writings, but in the whole content of the mind. A man must be ethical all over, not in spots only. For this reason the Herbartians speak fondly and proudly of *educative instruction,* meaning thereby such instruction as shall render all ideas contributory to moral character. But since feeling is the bridge between cognition and volition, this bridge the teacher must induce the pupil to cross if his conduct is to be adequate to his knowledge.

By means of direct interest incited in the pupil for the subject-matter itself, not amusement connected with the subject-matter, as some have erroneously thought, the pupil's permanent attitude of mind toward the circle of thought itself and consequently toward the aspects of life involved will be established. This interest falls naturally into two groups, first that pertaining to knowledge itself, and second that pertaining to intercourse with others. The first group embraces empirical, speculative (causal), and æsthetic interests; the second sympathetic, social and religious interests. This doctrine of interest, so important in modern educational thought, has been brought into harmony with our more spiritualistic systems of philosophy and psychology by Professor John Dewey ('Interest as Related to Will'). The next important topic arises when we ask how the teacher is to lead the pupil to build his circles of thought adequately, and then to have the right mental attitude toward them.

It is a common experience that faulty methods may easily lead to inadequacy of insight; they may still more easily lead to the wrong attitude of mind, as when the student hates a subject and everything connected with it. The first point to consider is *Attention,* which is either spontaneous or forced. With the young where forced attention is painful, it is better to induce spontaneous attention, for here the ideas rise freely, producing liveliness and pleasure. Apperception has two marked stages, that of *absorption,* in which the mind gives itself up to new impressions; and that of *reflection,* in which the newly acquired elements of knowledge find their appropriate place in the systems of the old. To bring about this twofold process of absorption and reflection most effectively and most agreeably to the mind, we must observe at least four prominent stages of method. The first of these is *clearness,* by which is meant the adequate apprehension of the single object or element as such. The second is *association,* which consists in the progress from one absorption to another related one. The third is *system,* or the step in which each part of that which is learned finds its proper place in relation to other parts. Steps two and three may be said to embrace the process of generalization. The fourth stage is what Herbart calls *method,* by which he understands the well-ordered activity of the pupil in the solution of problems and tasks.

Making due allowance for those parts of Herbart's system that are now of historical interest only, it may be seen that many of its elements are still of importance to the world, for they involve the most potent of modern educational processes and aims.

Herbart's chief philosophical works are 'Lehrbuch zur Einleitung in die Philosophie' (1813); 'Lehrbuch zur Psychologie' (1816); 'Psychologie als Wissenschaft, neu gegründet auf Erfahrung, Metaphysik und Mathematic' (1824–25); 'Allgemeine Metaphysik nebst den Anfängen der philosophischen Naturlehre' (1828–29); 'Kurze Encyclopädie der Philosophie, aus practischen Gesichtespunkten entworfen' (1831). The complete works of Herbart have been edited in 12 volumes by G. Hartenstein (Leipzig 1850–52). Herbart's educational works, including the 'Allgemeine Pädagogik' and the 'Umriss Pädagogischer Vorlesungen,' were edited by Dr. Otto Willmann in two volumes (Leipzig 1880). The Psychology is translated and to be found in the International Series, while the 'Allgemeine Padägogik' and the 'Umriss' are also found in English, the former under the title of the 'Science of Education,' by H. M. and E. Felkin (Boston 1893), and the latter under that of 'Outlines of Educational Doctrine,' trans. by Lange and annotated by De Garmo (New York 1901). The Herbartian School has produced a literature in metaphysics, psychology and education too voluminous for mention here. Consult Adams, J., 'Herbartian Psychology applied to Education' (Boston 1906); De Garmo, C., 'Herbart and the Herbartians' (New York 1895); Gockler, L., 'La Pédagogie de Herbart, Exposé et Discussion' (Paris 1905); Lang, O. H., 'Outlines of Herbart's Pedagogy, with a biographical Introduction' (New York 1894); Wagner, E., 'Die Praxis der Herbartianer; der Ausbau und gegenwärtige Stand der Herbartschen Pädagogik' (Langensalza 1900).

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HERBELOT, dĕr'blō, **Barthelemy d',** French Orientalist: b. Paris, 4 Dec. 1625; d. there, 8 Dec. 1695. Having gone through a course of study in the university of his native city, he applied himself particularly to the eastern languages, with a view to the elucidation of the Hebrew Scriptures. He visited Italy, and while there commenced his great work, the 'Biblithèque Orientale.' Recalled to Paris by Colbert, a pension was given him, that he might be at liberty to proceed with his undertaking. It was his first design to have published his collection in Arabic, and types were cast for the purpose of printing it. But the death of Colbert having interrupted this plan, he recomposed the work in the French language, as likely to prove more generally useful. He was appointed to the royal professorship of Syriac in 1692. His book was published in 1697, and after with a supplement at Maestricht (1776–81). The best edition of the 'Oriental Library' is that of The Hague (1777), with the supplements of Galland and Visdelou. Consult Goujet, 'Memoires sur le Collège de France' (Vol. III, Paris 1758); Lefranc, 'Histoire du Collège de France' (ib. 1893).

HERBERMANN, Charles George, American editor: b. Saarbeck, Westphalia, 8 Dec. 1840; d. New York, 24 Aug. 1916. He was educated at Saint Francis Xavier College, New York, and was instructor there from 1858 to 1869. From 1869 to 1914 he was professor of the Latin language and literature at the College of the City of New York, serving also as librarian after 1873. From 1905 to 1916 he was editor in chief of 'The Catholic Encyclopedia.' He delivered a course on German literature at the Catholic Summer School of America in 1896, and lectured frequently on philology and mediæval schools and educators. In 1913 he received the Laetare medal of the University of Notre Dame. His published works include 'Business Life in Ancient Rome' (1880); 'The Sulpicians in the United States' (1916); translations of Torfeson's 'History of Vinland'; 'Life of Bishop Dubois'; 'The Waldseemüller Map of 1507.' He edited Sallust's 'Jugurthine War' (1886); 'Sallust's Catiline' (1891); 'The Unpublished Letters of Charles Carroll of Carrollton'; Thébaud's 'Forty Years in the United States' and 'An English Colony in the United States.' He contributed to 'The Catholic Encyclopedia,' the *American Catholic Quarterly Review,* and the *Catholic World.*

HERBERT, Edward, LORD HERBERT OF CHERBURY, English philosopher: b. Eyton-on-Severn, near Wroxeter, 1583; d. London, 20 Aug. 1648. He was a famous soldier and diplomatist in his day, but at the present is remembered as an author and philosopher. At Paris, in 1624, he printed his famous book, 'De Veritate prout Distinguitur a Revelatione, a Verisimili, a Possibili et a Falso,' the object of which was to assert the sufficiency, universality, and perfection of natural religion, and thereby prove the uselessness of revelation. In 1624 he returned from France, and was created an Irish peer; and in 1629 became an English baron with the title of Lord Herbert of Cherbury. In the civil war he at first tried as far as possible to play a neutral part, but afterward sided with the Parliamentary party chiefly with a view, it appears, to save his property. The character of Lord Herbert is strongly marked in his memoirs, which show him to be vain, punctilious and fanciful, but open, generous, brave and disinterested. The 'De Veritate' was followed by works entitled 'De Causis Errorum' (1645); and 'De Religione Gentilium' (1663; Eng. trans. 1709). In 1649 was published his 'Life and Reign of Henry VIII.' The English style of Lord Herbert is strong, manly and free from the quaint pedantry of his age. He was one of the first to attempt a systematic proof of the sufficiency of natural religion. «Herbert's religious doctrine,» says Sidney Lee, «starts with the assumption that religion, which is common to the human race, consists merely of the five innate ideas or axioms that there is a God, that He ought to be worshipped, that virtue and piety are essential to worship, that man ought to repent of his sins, and that there are rewards and punishments in a future life. He regards Christianity as on the whole the best religion because its dogmas are least inconsistent with his five primary articles.» His autobiography remained in manuscript till 1764, when it was published by Horace Walpole. There is a recent critical edition by Sidney Lee (1886).

HERBERT, Edward, LORD HERBERT OF CHERBURY, **Autobiography of.** The 'Autobiography' of Lord Herbert of Cherbury is one of the most remarkable in the whole range of self-narrative. In point of time it was among the first important autobiographies in the English language, and it continues to hold its place as one of the most interesting and self-revealing — as one that cannot be passed over by a student who is in any way vitally interested in biography as a clue to man's nature or as a commentary upon the age in which it was written. It is worth while to know that a work which has afforded so much pleasure to the world lay in obscurity for many years, and was well-nigh lost. It appears that two copies were made, one of which was preserved at Lymore in Montgomeryshire; the other, after more than a century of drifting, was about 1737 handed over to Henry Arthur Herbert, Earl of Powis. Several pages of the Lymore manuscript were torn away or so stained as to be illegible, a loss which the second fortunately supplied. The Earl of Powis presented the originals to Horace Walpole by whom the narrative was first printed at Strawberry Hill in 1764. The 'Autobiography' is chiefly valuable as the record of an important representative of a distinguished family, told with a strict regard for truth, with a humble desire to be of service, and with a naive frankness that attracts while it amuses. The first paragraph is sufficient evidence of what has just been said, and is enough to convince a reader that the entire narrative is worthy of careful attention. Lord Herbert begins by lamenting that his own ancestors had not «set down their lives in writing and left them to posterity» that «their heirs might have benefited themselves by them more than by any else.» He wrote with a definite intention of serving his descendants. «I have thought fit,» he continues, «to relate to my posterity those passages of my life which I conceive may best declare me and be most useful to them. In the delivery of which I profess to write with all truth and sincerity as scorning ever to deceive or speak false of any: and therefore detesting it much more where I am under obligation of speaking to those near me: and if this be one reason for taking my pen in hand at this time, so as my age is now past three score, it will be fit to recollect my former actions, and examine what has been done well or ill, to the intent that I may reform that which was amiss, and so make my peace with God, as also comfort myself in those things which through God's great grace and favor have been done according to the rules of conscience, virtue, and honor.» We may agree with the words of the advertisement to the first printing: «Foibles, passions, perhaps some vanity, surely some wrong-headedness; these he scorned to conceal, for he sought truth, wrote on truth, was truth: he honestly told when he had missed or mistaken it. His descendants, not blind to his faults, but through them conducting the reader to his virtues, desire the world to make this candid observation with them, 'That there must have been a wonderful fund of internal virtue, of strong resolution and manly philosophy, which in an age of such mistaken and barbarous gallantry, of such absurd usages and false glory, could enable Lord Herbert to seek fame better founded, and could make him reflect that there might be a more desirable kind of glory than that of a romantic duelist.'» Lord Herbert brings his narrative down to the publication of *De Veritate,* in 1624, and then abruptly closes. The style, considering the age in which it was written, is straightforward and not unpleasing. Now and then occurs a passage of singular beauty, such as the account of Lord Herbert's observation upon the similitude between birth and death. In addition to the manner in which the work reveals the individuality of the author, it throws much valuable light upon the customs and spirit of the age. As a reader puts the book aside he will feel that Horace Walpole spoke the truth when he called it «perhaps the most extraordinary account that ever was given seriously by a wise man of himself.» The 'Autobiography' should be consulted in the edition of Saunders and Otley (London 1826), and particularly in that of Sidney Lee (ib. 1886).

Waldo H. Dunn.

HERBERT, George, English religious poet: b. at the Castle of Montgomery, Wales, 3 April 1593; d. Bemerton, March 1633. His father, Richard Herbert, came of an illustrious Welsh family; his mother, Margaret Newport, also of excellent family, is more remembered for her own noble character. Between her and her poet son was rare sympathy; she guided his life in all things and early destined him to the saintly career in which he came slowly to find his happiness. Upon her husband's death in 1597, the care of her 10 children fell to her. The eldest son was Edward, Baron Herbert of Cherbury (q.v.). The family went to Oxford in 1595, where George Herbert was brought up until 1605, when he entered Westminster School. From the first he distinguished himself, partly by his learning, partly by his daring, which showed itself in his attack in Latin epigrams upon Andrew Melville, the noted Presbyterian. In 1609 he was elected scholar of Trinity College, Cambridge, where three years later he took his degree. In 1614 he became a Fellow of Trinity, and won his Master's Degree in 1616. In 1619 he was elected Public Orator, an office he filled until 1627.

Until this election Herbert had looked toward a worldly career. Pride of family and ambition were strong in him; the influence of his relatives and friends at court was great; he knew his own powers. But all that the court favor bestowed upon him was the lay rectorship of Whitford (1623), a sinecure post which Sir Philip Sidney had held; and shortly afterward the death of his most powerful friends darkened the promise of worldly advancement, and aided his mother's effort to turn him to the Church. In July 1626, while yet a layman, he became prebendary of Layton Ecclesia, in the diocese of Lincoln. With the help of his mother and others, he restored the ruined church building—an act more expressive perhaps of the beauty-loving courtier than of the future parish priest.

His mother had married Sir John Danvers in 1609. Her death in 1627 called forth Dr. Donne's famous funeral sermon and her son's 'Parentalia.' This sorrow marks the beginning of George Herbert's nobler life. Shattered in health, and threatened with consumption, he resigned his oratorship and spent the next three years in London and Essex and Wiltshire. In 1629 he married Jane Danvers, a relative of his stepfather, and the next year he was presented to the living of Bemerton, with which his name is remembered. The short remainder of his life was remarkably active. In these years he wrote most of his poems and the best of them, and also the 'Character of the Country Parson.' He died of consumption. Later in the same year his famous book of poems, 'The Temple,' was published in Cambridge.

His extreme saintliness took no strange outward form, as did the piety of his friend Nicholas Ferrar, nor did it mar his writing with eccentricities of fervor or mysticism; his genius is entirely sane. In no English poet, religious or secular, do the small common-places of life count for more. In such poems as 'The Elixir,' with its famous praise of 'Drudgery Divine,' he insists on that kind of aspiration which scorns no humble or routine task; and his longest poem, 'The Church Porch'—a series of wise maxims for the familiar discipline of the soul—sums up the moral and religious traditions of the English race, though in his individual way. His genius is for common sense ennobled by lofty faith and passionate devotion. It is this normal quality in him, this quickness to find inspiration along the highway, rather than his frequent reference to ecclesiastical customs and offices, that makes him, as Coleridge said, the representative poet of the English Church.

Bibliography.—The best editions are by George Herbert Palmer; Grosart, in the 'Fuller's Worthies Library' and in the Aldine edition; the Pickering edition, with the 'Life' by Isaak Walton. For criticism, consult 'Introductions' to the above, especially to Palmer's edition; also, for a charming study, consult the essay on Lady Danvers in Louise Imogen Guiney, 'A Little English Gallery.'

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HERBERT, Henry William, «Frank Forester,» American author: b. London, England, 7 April 1807; d. New York, 17 May 1858. He was graduated from Caius College, Cambridge, in 1828; removed to the United States in 1831; and until 1839 was instructor in the Greek and Latin languages in a private school of New York. In 1833 he established and until 1836 was editor of the *American Monthly Magazine,* during a portion of that time with Charles Fenno Hoffman (q.v.) as associate. From 1834 he became largely known as the first important American writer on sports and out-of-door subjects. He wrote also on French and English history, and made excellent translations from Dumas and Sue. His volumes include 'Cromwell' (1837); 'Marmaduke Wyvil' (1843); 'The Cavaliers of England' (1852); 'The Chevaliers of France' (1853); 'The Puritans of New England' (1853); 'Field-Sports of the United States and the British Provinces' (1848); 'Sporting Scenes and Characters' (1857); 'Horses and Horsemanship of the United States and British Provinces' (1859).

HERBERT, Hilary Abner, American lawyer and politician: b. Laurensville, S. C., 12 March 1834. He was educated at the universities of Alabama and Virginia, studied law and was admitted to the bar. He began practice at Greenville, Ala., but served in the Confederate army as captain and colonel of the 8th Alabama regiment; being disabled at the battle of the Wilderness (1864), he retired from the army, and continued the practice of his profession, first at Greenville, then at Montgomery (1872). He was elected to Congress in 1877, and seven times re-elected; in three Congresses he was chairman of the committee on naval affairs and hence was prominently connected with the reconstruction of the navy. In March 1895, he was appointed Secretary of the Navy by President Cleveland, an office which he held until 1897. He subsequently practised law in Washington. Both in private and public life, he has always taken a prominent part in the reconciliation of North and South. He has published 'Why the Solid South? or, Reconstruction and Its Results' (1890); 'The Race Problem of the South' (1901); 'The Abolition of the Crusade and Its Consequences' (1912).

HERBERT, John Rogers, English historical and portrait painter: b. Maldon, Essex, 23 Jan. 1810; d. London, 17 March 1890. He studied at the Royal Academy, where he exhibited as early as 1830; later went abroad and in 1840 became a Roman Catholic, after which the subjects of his paintings were chiefly religious. In 1841 he was elected one of the masters of the government school of design at Somerset House, and in 1846 became a member of the Academy. His principal works are the frescoes in the peers' robing-room in the House of Lords; 'The Appointed Hour' (1834); 'King Lear Disinheriting Cordelia'; 'Sir Thomas More and his Daughter' in the Vernon collection at the National Gallery; and 'Saint Gregory Teaching His Chant.'

HERBERT, Sir Michael Henry, English diplomatist: b. England, 25 June 1857; d. Davos-Platz, Switzerland, 30 Sept. 1903. He went to Paris as attaché in 1879; was *charge d'affaires* at Washington (1888–89); secretary to the British legation at Washington (1892–93); at The Hague (1893–94); at Constantinople (1894–97); at Rome (1897–98); and at Paris (1898–1902). On 4 June 1902 he was appointed British ambassador to the United States, at Washington, in succession to the late Lord Pauncefote, and the following year was compelled by ill health to return to Europe.

HERBERT, Victor, American musical director and composer: b. Dublin, Ireland, 1 Feb. 1859. After studying music from his childhood in Germany, he was appointed principal 'cello player in the court orchestra, Stuttgart, from which time he appeared in concerts throughout Europe. In 1886 he took the position of solo 'cellist in the Metropolitan orchestra, New York, and has since been connected as soloist and conductor with the principal orchestras of the United States. Since 1894 he has been bandmaster of the 22d regiment band, New York, was conductor of the Pittsburgh, Pa., orchestra from 1898 to 1904, and since 1904 has conducted Victor Herbert's New York Orchestra. As a composer he has written 'The Captive,' an oratorio; and the comic operas, 'Prince Ananias'; 'The Wizard of the Nile'; 'The Serenade'; 'Cyrano de Bergerac'; 'The Ameer'; 'The Viceroy'; 'The Idol's Eye'; 'The Fortune Teller'; 'The Singing Girl'; 'Babette'; 'Babes in Toyland'; 'It Happened in Nordland'; 'Natoma'; 'Madeleine'; 'The Only Girl,' etc.

HERBIVORA, a group of mammals characterized by their herbaceous diet; the grazers or ruminants. The term is no longer in use.

HERBS, Culinary, fragrant or aromatic plants used to add flavor to food, especially stews, soups, dressings and salads. They usually owe these qualities to essential oils, which, being readily soluble or easily volatilized by heat, quickly permeate the mass of food in which they are mixed. The seed of some, as caraway, anise and dill, is employed; the foliage of others, as parsley, sage, thyme, is more frequently used. The former plants are cut and placed loosely upon sheets as soon as the seed reaches maturity; allowed to dry a few days; lightly thrashed and the seed cleaned; still further dried and stored in air-tight packages. The latter are gathered just before the first blossoms open, because they are then richest in flavor. With parsley the leaves are gathered as soon as mature, several cuttings being made in a season. They are then dried upon trays at a temperature below 120 degrees and in freely circulating air until crisp, when they are rubbed to powder and stored as above. Paper or pasteboard packages are bad, because they allow the flavors to escape. Both seeds and leaves may be used in decoction, being covered with vinegar or alcohol in stoppered bottles. Fresh herbs, which are always preferable to dried or decocted, are especially useful in salads; dried and decocted in dressings, stews, etc., and at seasons when fresh ones cannot be obtained. In the United States the species most in demand are parsley, sage, thyme, savory, marjoram, spearmint, dill, fennel, tarragon, balm and basil in nearly the order named. Parsley is beyond question the most popular because of its double use as a garnish and flavoring plant but sage is perhaps more frequently used in the latter capacity. It is most esteemed with pork, goose, duck and similar rich meats. Spearmint is used mainly with roast lamb; tarragon with boiled fish; dill with pickles; and the other kinds mentioned with mild meats such as turkey, chicken, veal, venison, etc. The kind, quantity and mixture used with each sort of food depends upon personal preference.

In general, herbs are of simplest cultivation. They usually prefer rather light, moderately rich, well drained soil and sunny exposures. Since the seeds of many are small or slow to germinate they are frequently started in a greenhouse, hotbed or window, and transplanted to the garden when they are large enough and when conditions are favorable. Clean cultivation and the removal of weeds is essential. The perennial kinds, such as sage, are often propagated by stem cuttings, divisions or layers; tarragon always thus because it does not produce seed; spearmint usually by cuttings of the rootstock. The great majority are grown as annuals, being replaced each spring with fresh plants. Commercially they follow such crops as early cabbage, peas, etc., thus permitting a double use of the same soil annually. They are easily grown for winter use in the borders of benches in the greenhouse or in boxes placed in sunny windows.

HERCULANEUM, hĕr-kū-lā'nē-ŭm, or **HERCULANUM**, Italy, an ancient buried city, about five miles southeast of Naples. Strabo says it was first occupied by Oscans, afterward by Tyrrhenians and Pelasgians, and then by the Samnites. It took part in the social war against the Romans. In the time of Sulla it was a *municipium* and a fortified town. It was situated between Neapolis and Pompeii, on elevated ground between two rivers, and its port was one of the best on the coast. It suffered in 63 A.D. in the same earthquake that nearly destroyed Pompeii. In the greater eruption of Vesuvius in 79 A.D. it was buried under a volcanic tuff formed of sand and ashes, partly consolidated by the agency of water. The site of Herculaneum, though well described, had been long sought in vain, when in 1713 three female statues (now in the Dresden Museum) were found in digging a well at Portici, a village situated on the ancient site. After this discovery further excavation was prohibited by the government, until in 1738 the well was dug deeper, and the theatre of Herculaneum was discovered. In 1750 a long, narrow passage, sloping down into the theatre, was opened, and is still the only way by which travelers descend to examine this structure. The excavations were continued more or less industriously for 50 years; but comparatively little progress was made, as the work was difficult and also dangerous to the houses in the populous villages of Resina and Portici, situated above. As soon as one part was excavated and explored it was filled up with the rubbish from a new digging. The theatre is the only building to be seen underground, and it is encumbered with the supports built to sustain the rock above it. It is a noble edifice, massively built of solid stone, and seated 8,000 persons. Bronze statues of Drusus and Antonia and of the Muses were found in various parts of the building. In a square on the south of the theatre a temple was found which was connected with another temple, to the east of it, by a wide street lined with porticoes. One of these temples, dedicated to the mother of the gods, had been restored by Vespasian after the earthquake of 63 A.D. On the north of the theatre was a basilica 228 feet long and 132 broad, surrounded by a portico of 42 columns, and adorned with paintings. Many beautiful paintings and works of art were removed from these buildings to the museum at Naples. A sumptuous private villa was disinterred, containing a number of statues, and in one of the rooms a quantity of papyrus manuscripts. Some of the statues are excellent as works of art, such as those of Agrippina, Aristides, the Sleeping Faun and the Mercury. Other precious relics discovered here, and now in the museum, are busts of Plato, Demosthenes, Scipio Africanus, Augustus, Seneca, etc., beautiful mosaics, and articles of furniture. New excavations were carried out in 1828–37, and since 1868. The chief discoveries made were those of the forum, a small and elegant temple, a basilica, a dilapidated building supposed to have been an inn, dwelling-houses, tombs, etc. One of the houses discovered at Herculaneum contained a quantity of provisions, dates, chestnuts, large walnuts, dried figs, almonds, prunes, corn, oil, pease, lentils, pies and hams, none of which had been disturbed for 18 centuries, for the doors remained fastened in the same state as they were at the period of the catastrophe which buried the town. The internal arrangement of the house, and the manner in which it was ornamented, proved that it had belonged to a rich family, admirers of the arts; for it contained many pictures, vases, articles in glass, bronze and terra-cotta. Few skeletons comparatively have been found either in Pompeii or Herculaneum, so that it is probable most of the inhabitants saved themselves by flight. At the door of a villa in Herculaneum were found two, one of which held a key in one hand, and in the other a bag with coins and cameos. Near them were silver and bronze vessels.

Among the most interesting objects discovered here are the papyri above mentioned, over 1,750 of which are now in the Naples Museum. The rolls are of cylindrical form, and much charred. Hardly a third of them have been unrolled. The process presents great difficulties, from the tendency of the MSS. to crumble. One of the works is a treatise by Epicurus on Nature; there are some writings of Philodemus, a Syrian philosopher; but on the whole they are of little value. There have been published 11 volumes of the 'Volumina Herculanensia,' containing engraved transcripts of the unrolled papyri (folio, Naples, 1793–1855), and since 1861 several volumes of a continuation of the same.

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HERCULES, hėr'kū-lēz, called by the Greeks HERAKLES, and also ALCIDES, al-sī'dēz, after his grandfather, Alcæus: a mythological hero of Greece, typified by poets, sculptors, and artists of later ages as a model of human perfection, physical and mental. According to the traditions of the heroic age, he united the finest qualities of mind and heart, as understood at that period, with the highest development of bodily vigor, and under a ceaseless succession of labors and sacrifices, strove perpetually after divine excellence. His indomitable perseverance was crowned with victories which showed the triumph of the divine part of man's nature over the earthly, while his death secured him immortality, a seat among the gods, and the homage of divine honors.

The legends relate that he was the son of Zeus or Jupiter, king of the gods, and of Alcmena the Theban, daughter of Alcæus, son of Perseus. Knowing that the child born on a certain day would rule over the descendants of Perseus, Hera or Juno, wife of Jupiter, consumed with jealousy, contrived to prolong the travail of Alcmena and hasten that of the wife of Sthenelus, another son of Perseus, who gave birth to Eurystheus, subsequently chief of the Persidæ. Hercules was brought up at Tirynthus, or according to Diodorus, at Thebes. Jupiter sought to protect his favorite son in every manner, and to make him worthy of immortality. On one occasion, while Juno was asleep, he laid the infant on her breast, that he might feed on the milk of the goddess. She awoke and cast the hated babe from her, and the drops that then fell from her are said to have formed the Milky Way. Under the care of Amphitryon, Alcmena's husband, Hercules received the best instruction in all arts. Castor, the son of Tyndarus, taught him how to fight; Eurytus, archery; Autolycus, driving; Eumolpus, singing; Linus, to play the lyre; and under the centaur Chiron he perfected his training, and became the most valiant and accomplished hero of the age.

In his eighteenth year he slew a huge lion in the neighborhood of Mount Cithæron which had preyed on the flocks of Amphitryon and of the king of Thespis. The king, desirous that his 50 daughters might have children by such a hero, entertained him at his court for 50 days, and Hercules became the father of their sons, the Thespiadæ. Hercules next freed his native city from the annual tribute of a hundred oxen, paid to Erginus, king of the Orchomenians. Creon, king of Thebes, rewarded Hercules by giving him his daughter Megara in marriage and intrusting him with the government of his kingdom. Subjected to the power of Eurystheus owing to priority of birth, the latter, acquainted with Hercules' successes and rising power, ordered him to appear at Mycenæ and perform the labors which he was empowered to impose upon him. Hercules refused, and Juno to punish him afflicted him with melancholic madness, during which he killed his own children by Megara, supposing them to be the offspring of Eurystheus. When he recovered he was so horrified by the misfortunes which had proceeded from his disobedience and insanity that he consulted the oracle at Delphi; he was told that he must be subservient to the will of Eurystheus and perform ten labors imposed by the king, after which he would attain immortality. Hercules thereupon went to Mycenæ, where Eurystheus, apprehensive of so powerful an enemy, commanded Hercules to achieve a number of enterprises the most difficult and arduous ever known. The favors of the gods, however, had completely equipped him for their performance; from Minerva he had received a coat of arms and helmet, a sword from Mercury, a horse from Neptune, a shield from Jupiter, a bow and arrows from Apollo, and from Vulcan a golden cuirass and brazen buskin with a celebrated brass club.

The first labor was to destroy the lion which infested the forests of Nemea and Cleonæ near Mycenæ and was invulnerable to mortal arrows. Hercules attacked him with his club, chased him to his den, and after a sharp and fierce struggle choked him to death. He carried the dead beast on his shoulders to Mycenæ, and ever after clothed himself with the skin. The second labor was to destroy the Lernæan hydra, which he accomplished with the assistance of his friend Iolaus, who burnt with a hot iron the root of each head as Hercules crushed it to pieces with his club. The third labor was to catch the hind of Diana, famous for its swiftness, golden horns and brazen feet. The fourth labor was to bring alive to Eurystheus a wild boar which ravaged the neighborhood of Erymanthus. In this expedition he destroyed the Centaurs, and caught the boar by closely pursuing it in the deep snow. In his fifth labor Hercules was commanded to clean the stables of Augeas, where 3,000 oxen had been kept for many years; this he accomplished in one day by turning the rivers Alpheus and Peneus through the stables, receiving as payment a tenth of the cattle and concealing the fact that he had been commanded to perform the service. The sixth labor was to destroy the carnivorous birds, with brazen wings, beaks and claws, which ravaged the country near Lake Stymphalis in Arcadia. In his seventh labor he brought alive into Peloponnesus the wild bull, a gift of Poseidon to Minos, king of Crete, which had laid waste the island. In his eighth labor he was commissioned to capture the mares of Diomedes, which fed upon human flesh. He killed Diomedes, and gave him to be eaten by his mares, which he brought to Eurystheus. For his ninth labor he was commanded to obtain the girdle of the queen of the Amazons. In his tenth labor he killed the monster Geryon, king of Gades, and brought to Argos his numerous flocks, which fed upon human flesh. Adjudging the second and fifth labors as unlawfully performed, Eurystheus imposed two others. These were: the eleventh, to obtain the golden apples from the garden of the Hesperides; and the twelfth, to bring from hell the three-headed dog Cerberus. Pluto promised him Cerberus on condition that he should use no weapons but force. Eurystheus, pale with fright when Hercules brought the monster to him, ordered its immediate removal. This ended what are generally known as the Twelve Labors of Hercules, and relieved the hero from bondage.

Besides these, Hercules achieved other labors equally great and celebrated, such as his war with Jupiter against the giants, his expedition with the Argonauts to Colchis, the pillage of Troy, the liberation of Prometheus and Theseus, etc. During three years' slavery, imposed by the Delphian oracle for plundering the temple to avenge supposed neglect, Hercules' mistress, Omphale, queen of Lydia, married him. Hercules afterward married Dejanira, daughter of Œneus, king of Ætolia, and when Iole, daughter of the king of Œchalia, a princess formerly refused to Hercules, became his captive, Dejanira sent Hercules the tunic given her by the dying centaur Nessus as having the power to recall a husband from unlawful love. The tunic had been infected by the poisoned arrow shot by Hercules at the centaur when he offered violence to Dejanira, after carrying her across the river Evenus. When Hercules put the tunic on, the poison penetrated his system and he suffered untold torments; in remorse Dejanira killed herself. In his agony Hercules had himself conveyed to Mount Œta and laid on a funeral pyre which at his commands was set on fire. In the midst of a dark cloud, accompanied by lightning and thunder, his immortal spirit was transported to Heaven, where he took his place among the gods, became reconciled to Juno and married her daughter Hebe.

While the myth of Hercules is of Greek origin, counterparts of the legend appear among many nations. Some scholars regard Hercules as a solar hero, and the twelve labors to represent the 12 zodiacal signs. Artists represent him under a variety of forms, as a child, a youth, and man, in his numerous adventures and exploits. The principal ancient statue is the Farnese Hercules at Naples, by the Athenian Glycon. In the Vatican, the Torso di Michelangelo, so called because that artist studied it during several years, is a remarkable fragment of an ancient statue of Hercules. Consult Gayley, ‘The Classic Myths’ (1911).

HERCULES, in astronomy, one of Ptolemy's northern constellations. It is within this constellation that the point toward which the sun, with its accompanying system of planets, is traveling at present is situated. The constellation contains the finest globular cluster of stars in the northern heavens, and the bright double and variable star Ras Algethi.

HERCULES, Pillars of, name of the Straits of Gibraltar among the ancients. Hercules is said to have erected a pillar on each side of the strait between Europe and Africa, upon the mountains Calpe and Abyla, as the limits of his wanderings toward the west. The earliest Greek writer by whom the Pillars of Hercules are mentioned is Pindar. On the other hand the Phœnicians called the strait the Pillars of Melkant (q.v.), whom the Greeks knew as Melicertes.

HERCULES-BEETLE, a very large South American lamellicorn beetle (*Dynastes hercules*). An enormous horn projects from the prothorax of the male and a smaller one from the head; they act together like a pair of forceps. The length of the male is about six inches but the female is smaller and lacks the horns. Numerous related species are known, of which *D. tityrus,* found in the southern United States, is two and one-half inches long.

HERCULES' CLUB, a North American shrub or tree growing to height of 12 feet and sometimes to 40 feet. See Aralia.

HERDER, Johann Gottfried von, yō hän gōt'frēd fōn hĕr'dĕr, German critic and poet: b. Mohrungen, Prussia, 25 Aug. 1744; d. Weimar, 18 Dec. 1803. He was the son of a poor schoolmaster, but friends procured him an appointment in Frederick's College, where he was at first tutor and at a later period instructor. During this period he became known to Kant, who permitted him to hear all his lectures gratis. His unrelaxing zeal and diligence enabled him to become acquainted with science, theology, philosophy, philology, natural and civil history and politics. In 1764 he was appointed an assistant teacher at the cathedral school of Riga, with which office that of a preacher was connected. In 1769 he went to Paris; he became traveling tutor to the Prince of Holstein-Oldenburg, but in Strassburg he was prevented from proceeding by a disease of the eyes; and here he became acquainted with Goethe, on whom he had a very decided influence. Herder had already published his ‘Fragments on the More Modern German Literature,’ his ‘Critical Woods’ (Kritische Wälder), etc., which had gained him a considerable reputation, though he had not published anything of importance in theology; yet, while in Strassburg, he was invited to become court preacher, superintendent and consistorial councillor at Bückeburg, whither he proceeded in 1771. He soon made himself known as a distinguished theologian, and in 1776 received an invitation to become court preacher, general superintendent and consistorial councillor at Weimar. This appointment was through the influence of Goethe. In 1801 he was made president of the high consistory, a place never before given to a person not a nobleman, and was subsequently made a noble by the Elector of Bavaria. As a theologian Herder contributed to a better understanding of the historical and antiquarian part of the Old Testament. His ‘Geist der hebräischen Poesie’ is highly valued. He did much for the better appreciation of the classical authors, and his philosophical views of human character are full of instruction. His greatest work is his ‘Ideen zur Philosophie der Geschichte der Menschheit’ (1785 et seq.). In poetry Herder effected more by his various accomplishments, his vast knowledge and fine taste than by creative power; yet he has produced some charming songs; and his ‘Cid,’ a collection of Spanish romances into a kind of epic, is one of the most popular poems of Germany.

HEREDIA, ā-rā-de'a, **José Maria,** Spanish-American poet: b. Santiago de Cuba, 31 Dec. 1803; d. Toluca, Mexico, 7 May 1839. He was graduated from the law department of the University of Havana in 1819; for taking part in the attempted revolution of 1823 was banished from Cuba, lived for two years in the United States and in 1825 removed to Mexico, where he held various civil, judicial and journalistic positions. His poetic works have been to some extent rendered into other languages. The ‘Ode to Niagara’ is well known. Heredia has been considered by many the greatest of Spanish-American poets. One of the best editions is that of Ponce de Leon, ‘Obras Poeticas de Don José Maria de Heredia’ (1875).

HEREDITARY MONARCHY. See Monarchy.

HEREDITY. So long as the part played by the male and female in procreation was obscure, as it was to the ancients, it was impossible to arrive at a clear idea concerning the relationship of offspring to parents, but after Spallanzani's discovery that the solid part only of the sperm forms the fertilizing agent, and more especially after Hamm's identification of the spermatozoon, it became possible to study the method of inheritance more directly. At the time when these advances were made the doctrine of praeformation was still generally held and the attempt to harmonize the new discovery of the spermatozoon split the praeformation school into two schools. According to one side, the ovists, the egg contains in miniature a germ in all essential respects, except size, like the parent. The spermatozoon only starts the vital processes but contributes nothing material to the result. Heredity, therefore, *sensu strictu,* could only take place through the female. According to the other side, the spermists, the spermatozoon contained the praeformed germ of the individual, and the egg supplied only the pabulum for its expansion and growth. Both ovists and spermists were logically forced to the further assumption that each germ contained within itself other germs and these still others, and so, if not *ad infinitum,* still each contained a sufficient number of enclosures to insure the perpetuation of the species as long as its predestined course was to last.

This deadlock was broken with the discovery of the cell (1838-39) and the part it plays in fertilization. Plants and animals have been found to be made up of modifications of a single unit called the cell — a mass of protoplasm usually surrounded by a membrane and containing a central sphere or nucleus. The egg is such a cell — one so simple as compared with its many modifications in the body that the egg is almost an idealized type of the cell. Minute study of the spermatozoon and its origin revealed that it, too, starts as a cell as simple as the egg cell. Fertilization was found to consist of the union of these two cells, one from one parent and one from the other, at least in all animals and plants in which the sexes are separate. By union of the two cells a single cell is produced which through division gives rise to the host of cells of which the new individual is produced. Every cell of the new individual contains all the hereditary elements derived from the two parents. These hereditary elements are now recognized as contained in the cell in certain threads called chromosomes that are the essential elements of the nucleus of the cell. The number of chromosomes is definite for each species of plant or animal. The numerical constancy is maintained by a division that takes place in the ripening of the egg and of the sperm mother cell, for at this time a process occurs that need not be further described here (see below), which leads to a reduction in the number of chromosomes to a single set — one of each kind. By the union of these reduced cells in fertilization the double number of chromosomes is again restored. This demonstration of the duality of the hereditary elements in the fertilized egg with the consequent duality of the same elements in every cell of the adult body is the most important contribution of modern cytology to the theory of heredity.

While these discoveries were being made during the latter part of the last century, discoveries that were destined ultimately to throw a flood of light on how inheritance is brought about, a doctrine was attracting widespread attention, but has never succeeded in being brought into systematic relation with our knowledge concerning the cell.

In 1809 Lamarck had advocated the view that evolution is due in part to the direct influence of the environment, especially in plants, and in part to the inheritance of structural and physiological changes that first take place in the body of animals as a result of use and disuse of its parts. The doctrine involves the idea that in some way the germ cells respond specifically to changes in the body. Darwin accepted Lamarck's view (although Darwin erroneously supposed that Lamarck held a view essentially different from his own) and advanced in 1866 a tentative hypothesis as to how somatic modifications could affect the germ cells. His view was the first attempt to show how such a process, that had been vague — even mysterious, might be made compatible with the teaching in regard to cell structure and physiology that had at that time made very considerable advances. This is the famous hypothesis of Pangenesis. Darwin suggested that every cell of the body is, at all times, throwing off minute representative particles called gemmules which leave the cell, and, migrating through the fluids of the body, finally reach the germ cells into which they enter, and which in a sense they construct. It was assumed that the gemmules from every part of the body unite in the germ-cells with like particles. These particles determine in some way, not clearly specified by the theory, the nature of the organs or characters of the new individual that develops from the egg.

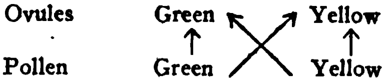
No evidence whatsoever in favor of the liberation of living units from the body cells, their accumulation in the germ cells and fusion there of like with like gemmules is to be found in the modern work on the germ cells. Moreover, a critical examination, especially in Weismann's hands, of the evidence on which was rested the entire theory of inheritance of acquired characters, has shown that this evidence was in part mythical and in part due to uncritical deductions.

Beginning in 1883 August Weismann in a series of essays that were in part speculative, yet backed by a constant appeal to observation and experiment, attacked the prevailing idea that characteristics acquired by the individual are transmitted to the germ cells and may reappear in the offspring. The germ cells had been shown in many cases to separate themselves at an early stage in the development of the embryo from the rest of the cells, remaining in an unspecialized condition while the remaining cells from which the body of the individual is to be formed were differentiating. The germ cells become later the essential parts of the ovary and testis respectively. In origin, therefore, they are independent of the rest of the body and have never been a constituent part of it. They are protected and nourished by the body, but not otherwise influenced by it. The germ tract is the imperishable stream which throws off in each generation the body cells whose destiny is to maintain the germ cells. All new modifications arise primarily in the germ cells, and first show themselves as characters in the individuals that develop from these germ cells. Evolution is germinal in origin and not somatic as had been earlier taught. This idea of the origin of new characters is held almost universally to-day by biologists. Heredity is due, therefore, to the conservation in the germ plasm of those elements that have appeared in it from time to time — the old as well as the new. The germ plasm is the capital of the race of which the interest only is spent in each generation in producing new individuals.

Darwin held not only that somatically "acquired" characters are transmitted, but also that new characters arise in other ways, in the main through the action of the outer world on the germ cells themselves. To this source he attributed many of the differences shown by individuals of any race or species. Darwin knew that some of these differences were due directly to the environment in which the individual was reared and were not inherited, but others he thought were in the germ stream and hence were transmitted (inherited). Darwin thought that the latter variations were different from the larger differences that sometimes appear and which were known to the breeder as «sports» (now as «mutations»). The former he believed to furnish the principal material on which natural selection acts to bring about evolution, while the larger and sudden changes or «sports» rarely if ever furnished the materials for evolution. To-day it appears that no such distinction exists and that all variations, whether large or small, that are inherited, arise in the same way, viz., as sudden changes (mutations) in the germ-plasm. Galton, whose studies in heredity, particularly those of human heredity, are based on much the same kind of evidence in regard to variation as that to which Darwin appealed, appreciated more fully the significance of discontinuity in the origin of new characters, but in his treatment of the inheritance of characters he made no sharp distinction between the methods of transmission of «blended» inheritance and «mosaic» inheritance and handled both by the same mathematical method. Nevertheless, Galton's introduction of exact mathematical and quantitative methods has had an important bearing on all recent work. Its later development, especially by Pearson and the school of Biometry, has furnished the Mendelian school with formulae indispensable for testing the validity of much of their data.

Galton reached the conclusion that the two parents of a given individual contribute to it on the average half of its inheritance; the four grandparents collectively one-fourth of its inheritance, the great-grandparents one-eighth, etc. The assumptions on which this theory rests have been shown (see below) to be wrong, for the procedure by which the hereditary elements are sorted out in successive generations is incompatible with such an assumption in individual cases. Individual analyses rather than study of mass phenomena gave the successful method through which the real hereditary mechanism was discovered by Mendel in 1865.

Mendel's two laws of heredity have been shown to hold not only for many plants, but for man and other animals, for birds, amphibia, fish, molluscs, crustacea, insects, etc. It has been found that Mendel's laws apply not only to characteristics of cultivated plants and animals, not only to superficial things such as color, but to the characters of wild animals, to differences that distinguish species, and to the most fundamental attributes of living things. Mendel's law of segregation states that the elements that the two parents contribute to the offspring constitute pairs, and that the members of each pair separate in the formation of the germ cells in the offspring so that each germ cell contains one member only of each pair. For example, Mendel crossed a race of edible peas having green seeds to one having yellow seeds. All of the offspring seeds were yellow. Yellow dominates green. If plants from these hybrid peas are self-fertilized (or crossed to each other) they produce both yellow and green peas in the ratio of three yellows to one green. These green peas are pure and never produce anything but green peas. The yellow peas, however, were found to be of two kinds, some were pure yellow always producing all yellow descendants, others were hybrids, producing both yellow and green peas in the ratio of three to one. Taken altogether these second generation peas appeared in the proportion of one pure yellow, two hybrid yellows, one pure green. Mendel pointed out that if the original green grandparent contributed an element for green and the yellow grandparent an element for yellow, these contrasted elements form a pair in the hybrid — a pair whose members separate (segregate) from each other when the germ cells (gametes) are produced. In consequence, half of the ovules will contain the element for yellow and half the element for green; likewise half of the pollen grains will contain the element for yellow and half the element for green. Chance meetings of the ovules and pollen, thus:



will give 1 green green; 2 green yellow; 1 yellow yellow.

Mendel's second law deals with cases where more than one pair of characters are involved. It has been found that tall and short races of peas are contrasted characters that segregate in the same way as do yellow and green. If a tall race with yellow peas is crossed to short race with green peas, the segregation of each pair is independent of that of the other, so that one-quarter of the egg cells of such a hybrid contains the elements for tall and yellow; another quarter the elements for tall and green; another quarter the elements for short and yellow, and another quarter for short and green. Similarly in the formation of the pollen of the same four kinds of gametes are produced. Chance meetings of ovules and pollen give 16 combinations as shown in the following diagram.

POLLEN	Ovules			
	Tall Yellow	Tall Green	Short Yellow	Short Green
Tall Yellow	Tall yellow Tall yellow	Tall green Tall yellow	Short yellow Tall yellow	Short green Tall yellow
Tall Green	Tall yellow Tall green	Tall green Tall green	Short yellow Tall green	Short green Tall green
Short Yellow	Tall yellow Short yellow	Tall green Short yellow	Short yellow Short yellow	Short green Short yellow
Short Green	Tall yellow Short green	Tall green Short green	Short yellow Short green	Short green Short green

Since yellow dominates green and tall dominates short, there are in this second filial (F_2) generation nine tall yellow; three short yellow; three tall green; one short green. Thus, while members of each pair of factors of the hybrid segregate at the time of ripening of the germ cells, the separation is independent for each pair. This is Mendel's second discovery that may be called the law of independent assortment.

Mendel showed that three pairs of characters behave in the same way, i.e., their genes assort independently, and there is reason to suppose that this law holds whenever the genes for the two or more pairs of characters are carried by separate pairs of chromosomes, but, as will be shown below, whenever the genes are carried by the same pair of chromosomes the distribution is controlled by a third law of heredity, viz., the law of linkage.

The elements that are supposed to represent, in a sense, the hereditary characters are commonly called genes and the word Genetics, or the study of behavior of the genes, has come to replace, in the modern work on inheritance, the older term Heredity with its numerous connotations. The Mendelian characters have been spoken of as unit characters, and it is sometimes implied that the gene directly produces each such character. The clearest evidence, however, indicates that the so-called unit character is only one of the many effects which the gene may produce in conjunction always with many, perchance with all of the other genes. Thus, the germ plasm is looked upon as the sum total of the genes whose combined effect is responsible for each character of the body. While the body is built up through the interaction of the materials that the gene produces, yet in the formation of the germ cells the genes act as independent units that collect in pairs, then segregate, those pairs in separate pairs of chromosomes assorting independently; those pairs in the same chromosome pair being linked.

Modern work on the cell has pointed unmistakably to the mechanism by means of which both segregation of the genes and the assortment of the chromosomes takes place. Every cell in the body or immature germ cell contains a double set of chromosomes (except in the male of certain groups, which lacks one of the sex chromosomes); one member of each pair has come from the father and one from the mother. During the maturation process the maternal and the paternal chromosomes mate with each other — like with like. Subsequently at the so-called reduction division one member of each pair goes to one daughter-cell and the other member to the other daughter-cell. If the chromosomes carry the Mendelian genes the maternal and the paternal genes will be segregated when the chromosomes are reduced to produce the gametes; but at the reduction division there is not a separation of all the maternal from all of the paternal chromosomes as a group, but each pair of chromosomes segregates independently of the others, so that the daughter-cells may get any possible assortment of the chromosomes of paternal and maternal origin, but always one or the other member of each pair. This condition fulfills all the requirements of Mendel's second law of free assortment.

But obviously if, as assumed, the chromosome threads are the bearers of the genes and if, as generally held to-day, the thread is a structural element that remains intact even in the resting stages of the cell, then the genes must be inherited in groups corresponding in number to the number of the chromosomes. In a word, all the genes in a given chromosome will be linked together. The most recent evidence shows that this is the case, and that there are as many groups of linked genes as there are kinds of chromosomes. Since 1906 the number of demonstrated cases of linked genes has steadily increased so that it can no longer be questioned that this relation is a characteristic feature of Mendelian inheritance. In one instance, that of the fruit fly, Drosophila ampelophila, it has been shown that the 200 known hereditary differences are inherited in four groups corresponding to the four pairs of chromosomes. Thus, Mendel's law of segregation has found its justification in the cytological mechanism of reduction in the germ cells; while his law of free assortment has been confirmed in the method of assortment of the chromosome. Later the discovery of the meaning of linkage phenomena has brought all the fundamental properties of heredity into complete harmony with the chromosomal mechanism. The individuality of the chromosomes that is responsible for linkage has been found, however, not to be absolute, for the members of a pair have been shown to interchange equivalent parts at times, but the interchange has been found to follow a predictable course, and while it complicates the results, in no sense undermines the general principle involved. In some species the interchange (crossing over) takes place only in the female sex (Drosophila), in others in the male sex (silkworm moth), while in still others it takes place in both sexes, as in some hermaphroditic plants.

The inheritance of sex has been one of the great biological discoveries of the present century. The factor or factors of sex have been shown to be carried by special chromosomes called the sex chromosomes. In certain great groups (mammals, most insects, etc.) the occurrence of two of these chromosomes, called the X chromosomes, produces a female, the presence of one of them produces a male. Thus the female is XX, the male X. At the reduction division in the female one X is eliminated from the egg so that each egg contains but one X chromosome. In the male there is only one X, this X chromosome goes in the reduction division to only one sperm cell of the two formed, so that two classes of spermatozoa result. At the time of fertilization random meeting of any egg with any spermatozoon will give two classes of individuals, those with two X's (females) and those with one X (males). This mechanism preserves the numerical equality of the sexes. In other groups (birds, moths) the relation is reversed, the male containing two X's, the female one; hence all of the spermatozoa contain one X; half of the eggs contain but one X, the other half none. This mechanism gives the same numerical results but the sex factors are presumably different. In hermaphroditic forms all of the individuals are alike in their chromosomal numbers, and the differentiation of testes in one part and ovaries in another part of the same individual must be determined by the same kind of relation that determines the differentiation of any of the organs of the body. This is not the result of different chromosomal complexes but of the relation of the protoplasmic parts to each other.

In consequence of the method of distribution of the sex chromosomes a unique type of inheritance called «sex linked inheritance» has been recognized. The sex chromosomes carry many other factors besides the sex factor which follows the distribution of the sex chromosomes. Thus, in man certain kinds of color blindness and hemophilia (bleeding resulting from failure of the blood to coagulate) are inherited as follows: an affected male transmits his characteristics to half of his grandsons but to none of his sons, daughters or granddaughters; but all of his daughters and half of his granddaughters carry his affected X chromosomes, and reproduce their peculiarity in half of their sons. Conversely, an affected female transmits her peculiarity to all of her sons (since each gets her affected X chromosome) but to none of her daughters since the other X chromosome that they receive from their father counteracts the injurious effect of the maternal X chromosome, etc. In birds, where the female is X and the male XX, these relations are just reversed.

The word heredity has come to-day to have a more precise meaning than in the past, because the recurrence of characters in successive generations is now known to come not from the body of the parent, but to be an expression of the factorial composition of the germ plasm. The germ plasm is the heritage of the species or race and changes only through mutation in one or more of its elements or genes. The character of each individual that arises out of this germ plasm is determined by the sum total of the factors contained in the germ, which factors acting on the cytoplasm determine the character of the result in any given environment. Heredity is the name given to express this relation of continuity of the germ plasm material and its consequences in the successive generations that arise from the germ plasm.

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HEREFORD, hĕr'ĕ-fōrd, England, a city and parliamentary borough, capital of Herefordshire on the Wye, 144 miles by rail northwest of London. The chief building is the cathedral, built in 1012–56, rebuilt in 1072, and restored in 1863. It is of early Norman architecture, 335 feet long and 174 feet wide, contains many fine monuments, some as ancient as the cathedral, and its accessory features include a lady chapel, charterhouse, cloisters, an episcopal palace and a library containing valuable MSS., Wyclif's Bible, and a 13th century map of the world. A musical festival of the united choirs of Gloucester, Worcester and Hereford is given in the cathedral triennially. Cider and brewing and the making of excaustic tiles are among the industries. David Garrick was a native. The see dates from 673; the city was incorporated in the reign of King John. Pop. 22,568.

HERESY (Gr. *hæresis*) primitively means a choice or election, and in its application to religious belief is used to designate as well the act of choosing for one's self, and maintaining opinions contrary to the authorized teaching, as also the heterodox opinions thus adopted. In the Acts of the Apostles the word seems to be used of a sect or party, apart from the consideration of its character, whether good or bad; but in the Epistles and in the early Christian writers it is almost invariably used in an evil sense, which is the sense uniformly accepted in all subsequent theological literature down to recent times.

Even in the apostolic times heresies had arisen in the Church, and before the Council of Nice the catalogue of sects had already swelled to considerable dimensions.

From the very date of the establishment of Christianity in the Roman empire heresy appears to have been regarded as a crime cognizable by the civil law; and Constantine enacted several severe laws for its repression, which were continued and extended by his successors, and were collected into a single title, 'De Hæreticis,' in the Justinian code. The penalties of heresy ordained by these enactments are very severe, extending to corporal punishment, and even to death; and they all proceed on the distinct assumption that a crime against religion is a crime against the state. These enactments of the Roman law were embodied in the various codes of the European kingdoms; in English law heresy consisted in holding opinions contrary to the faith of Holy Church. By common law the offender was to be tried in the provincial synod by the archbishop and his council, and, after conviction, was to be given up to the king to be dealt with at his pleasure. But the statute 2 Hen. IV, chap. 15 (*De hæretico comburendo*) empowered the diocesan to take cognizance of heresy, and, on conviction, to hand over the criminal directly, and without waiting for the king's writ, to the sheriff or other competent officer. This statute continued practically in force, with certain modifications, till the 29 Charles II chap. 9, since which time heresy is left entirely to the control of ecclesiastical legislation.

The doctrines considered heretical by the Christian Church may be found in the 'Dictionnaire des Heresies,' by the Abbé Pluquet, with the history, progress, nature, and also the refutations of their errors. From the viewpoint of the Roman Catholic Church all Protestants (including in this term Anglicans) are accounted heretics; the right of private judgment is the keystone of Protestantism. The Protestant churches have themselves judged members who have dissented on doctrinal points heretics, and the Anabaptists were at one time so regarded; but with increasing toleration prosecutions for heresy are becoming very infrequent and are not regarded as excluding from the fellowship of believers those who thus come under the ban of ecclesiastical censure or disapproval.

HERETIC, in ecclesiastical terminology, one who embraces a heresy. It is evident that the word heretic can have only the relative meaning of heterodox. The early Christian Church always made a distinction between heretics who obstinately persisted in their heresy, and heretics merely through error, or who had been born in heresy. The fathers of the Church declare themselves ignorant of the final condition of the latter. Again, peaceable heretics are distinguished from those whose doctrines produce public confusion and disorder.

HEREWARD, hĕr'ĕ-ward, a Saxon yeoman who flourished about 1070. He was practically the last to withstand the Normans, holding the Isle of Ely against William the Conqueror 1070–71. After William had succeeded in reaching the refuge of the Saxon patriots, Hereward, scorning to yield, fled to the fastness of the swampy fens to the northward. He was commonly styled Hereward the Wake, and his character and adventures form the theme of Charles Kingsley's popular historical romance, ‘Hereward.’

HERFORD, Oliver, American humorous author and illustrator: b. England, 1863. He was educated at the Slade School, London, and Julien's, Paris. Among his works are ‘Artful Antics’; ‘The Bashful Earthquake and Other Fables and Verses’ (1898); ‘Alphabet of Celebrities’ (1899); ‘A Child's Primer of Natural History’ (1899); ‘Wagner for Infants’ (1899); ‘Overheard in a Garden’ (1900); ‘Rubaiyat of a Persian Kitten’ (1904); ‘The Fairy Godmother-in-Law’ (1905); ‘Peter Pan Alphabet’ (1909); ‘Kitten's Garden of Verses’ (1911); ‘The Mythological Zoo’ (1914); ‘Pen and Inklings’ (1917); ‘Confessions of a Caricaturist’ (1917).

HERING, Ewald, German psychologist: b. Altgersdorf, Saxony, 5 Aug. 1834. He studied medicine, and settled at Leipzig as physician in 1860; in 1862 he was lecturer in physiology at the Leipzig University, and in 1865 was professor of physiology and medico-physics in a medical school at Vienna, and in 1870 held the same chair at Prague. Hering is best known for his work in the field of psychophysics, especially for his investigations of visual space perception and for the color theory which he originated. This theory is opposed to the empiristic theory of Helmholtz and is most generally accepted by psychologists at the present time. His writings include ‘Die Lehre vom Binocularen Sehen’ (1860); ‘Zur Lehre vom Lichtsinne’ (1872–74); ‘Der Raumsinn und die Bewegung des Auges’; ‘Das Gedächtniss als eine allgemeine Funktion der organisierten Materie’ (1870); ‘Grundzüge einer Theorie des Temperatursinnes’ (1877); ‘Handbuch der Physiologie’; ‘Ueber Newtons Gesetz der Farbenmischung’ (1887); ‘Grundzüge der Lehre vom Lichtsinn’ (1905–11), and many papers on visual theory.

HERING, Rudolph, American hydraulic and sanitary engineer: b. Philadelphia, Pa., 26 Feb. 1847. He was graduated at the Dresden (Germany) Polytechnic School, 1867, and became assistant engineer of Prospect Park, Brooklyn, N. Y., the following year. He was assistant engineer of Fairmount Park, at Philadelphia, 1869–71, and astronomer at Yellowstone National Park in 1872. After serving as assistant city engineer 1873–80 he opened an office for private practice in engineering and has furnished designs for sewerage and water supply for numerous towns and cities in the United States, Canada and South America. He is member of many professional societies both in Europe and America, and has written many published reports on sewerage and water supply of cities. He was president of the American Public Health Association in 1913–14.

HERIOT, hĕr'ĭ-ŏt, **George,** Scottish philanthropist: b. Edinburgh, 1563; d. London, 12 Feb. 1624. His father was a goldsmith in Edinburgh, and the son followed his father's profession, and was admitted a member of the Incorporation of Goldsmiths in May 1588. In 1597 he was appointed goldsmith to the queen by a charter from James VI and on the accession of the latter to the English crown followed the court to England. From the period of Heriot's settlement in London little is known of his history. He died on 12 Feb. 1624, and was buried at Saint Martin's-in-the-Fields. By his will he left nearly the whole of his fortune toward the founding and erecting of a school for poor boys in Edinburgh, styled in the bequest a «hospital.» The foundation of the present structure, known as Heriot's Hospital, was laid in July 1628; and the expense of the erection exceeded £30,000 sterling. From the rise in value of property the yearly revenue of the hospital has very greatly increased; and the governors were empowered in the reign of William IV to establish elementary schools within the city for the gratuitous education of poor children, 16 day schools being ultimately established, besides evening schools. In 1885, however, an entirely new scheme was introduced and a great part of the funds are now devoted to the support of Heriot's Hospital School and the Heriot-Watt College. The former is a day school for boys of 10 and upward, and the Heriot-Watt College is a college giving a thorough technical, commercial and literary education chiefly by evening classes, though there are also day classes. The annual revenue is now about $150,000.

HERKIMER, Nicholas, American military officer: b. about 1715; d. Danube, N. Y., 17 Aug. 1777. He became a lieutenant of militia, served in the French and Indian War, and defended Fort Herkimer in 1758. Promoted brigadier-general of militia in 1776, he directed operations against Sir John Johnson, and when Fort Stanwix was threatened by a combined force of Indians, Tories and regulars, advanced to its relief. He was ambushed by Col. Saint Leger at Oriskany, and one of the most closely-fought battles of the Revolutionary War followed. Herkimer having lost a third of his force, was unable to continue, and Saint Leger's army was rendered thoroughly ineffective. Herkimer himself was wounded, and died as the result of an unskilful operation. The town and county of Herkimer, N. Y., were named in his honor.

HERKIMER, N. Y., village, county-seat of Herkimer County; on the Mohawk River, the Erie Canal and on the New York Central and

Hudson River Railroad; about 25 miles east of Utica and 68 miles northwest of Albany. The chief manufactures are flour, furniture, mattresses, knit goods, beds, paper, creamery products, leather board, boxes, hardware and cigars. The city owns and operates the electric plant and the waterworks. It is the seat of Folts Mission Institute, has a public library and a hospital. Fort Dayton occupied the northern part of Herkimer and before 1807, when it was incorporated the village was called Fort Dayton. Pop. 7,520.

HERKOMER, Sir Hubert von, English painter: b. Waal, Bavaria, 26 May 1849; d. 31 March 1914. His father, a wood carver, went to America in 1851, but returned to Europe and settled in Southampton in 1857. Hubert studied at the school of art in that city, where he assisted in founding a life school for drawing. In 1867 he exhibited in the Dudley Gallery. His first picture exhibited at the Royal Academy, 'After the Toil of the Day' (1873), a German subject, attracted attention; and two years later he gained a great reputation by his famous picture representing 'The Last Muster — Sunday at the Royal Hospital, Chelsea.' Later pictures are 'Eventide: a Scene in Westminster Union' (1878), «a worthy companion of the other realistic yet more heroic study of old age, which the artist made in his Chelsea Pensioners»; 'Missing: a Scene at the Portsmouth Dockyard Gates' (1881), «a masterpiece in its way»; 'On Strike' (1891), his diploma work; 'Back to Life' (1896); 'The Guards' Cheer' (1898), representing a scene in the Diamond Jubilee procession and 'Portrait of Queen Victoria' (1901). Among many portraits painted by him the best known are those of Wagner, Ruskin and Tennyson. His best water-color pictures are 'Im Walde'; 'The Woodcutter's Rest'; 'The Poacher's Fate'; and 'At the Well.' Mr. Herkomer was elected a member of the Royal Academy in 1890, from 1885 till 1895 held the Slade professorship of fine arts at Oxford in succession to Mr. Ruskin and was knighted in 1907. He held a life professorship at Munich, and superintended an art school founded by himself at Bushey in Hertfordshire. At the Royal Academy Summer Exhibition of 1914 the largest canvas exhibited was Herkomer's 'The Managers and Directors of the Firm of Fried. Krupp, Essen, Germany' He was a man of the utmost versatility, and according to the obituary notice in the London *Times* he «could paint, etch, engrave, work in metal, enamel, play the zither and piano, compose music, write plays, and act them,» and he paid much attention to cinema work. Consult for an account of his principles 'My School and My Gospel' (1908); also his autobiography 'The Herkomers' (1910).

HERMANDAD, ĕr-män-däth', a confederation of the cities of Aragon, formed to defend themselves against the usurpations and the rapacity of the feudal nobility. This object was most clearly apparent in the brotherhood (Hermandad) formed about the middle of the 13th century in Aragon, and that formed about 1282 in Castile. In 1295, 35 cities of Castile and Leon formed a joint confederacy for the same object. These fraternities were the model of the later Hermandad of the municipal communities, which was formed in Castile under the reign of Ferdinand and Isabella. It was established in 1486 with the approbation of the king. The city authorities raised a military force and appointed judges in different parts of the kingdom. Neither rank nor station protected the offender against the tranquillity of the country, nor could he find safety even in the churches. The Santa Hermandad (holy brotherhood) which readers of Don Quixote will be acquainted with, had, like the earlier institution, of which it was a continuation, the object of securing internal safety, and seizing disturbers of the peace and highway robbers, but did not act except in case of offenses actually committed. It consisted of a company of armed police officers, who were distributed in the different provinces of the kingdom of Castile, and whose duty it was to provide for the security of the roads outside of the cities. One of their strictest regulations was not to use their power within the cities. They were subject to the council of Castile. The principal divisions of the company had stations at Toledo, at Ciudad Rodrigo, and at Talavera.

HERMANN, hėr'män, **Alexander**, American conjurer: b. Paris, France, 10 Feb. 1844; d. near Great Valley, N. Y., 17 Dec. 1896. From his brother Carl, Alexander took his earliest lessons in sleight-of-hand and the brothers then traveled in Europe and became widely known as skilled conjurers. Coming to the United States in 1867 they met with great success. The elder presently returned to Europe, but Alexander became a citizen of the United States, made a tour of the world and had few equals in his profession.

HERMANN, Friedrich Benedikt Wilhelm von, German economist: b. Bavaria, 1795; d. 1868. He received his education at Erlangen and Würzburg, where he gave special attention to political economy. He was appointed privatdozent at Erlangen in 1823 and two years later became professor of mathematics at the Nuremberg Gymnasium. In 1827 he was named professor extraordinary at the University of Munich. He was elected to the Bavarian Academy of Science in 1835 and also served as inspector of technical instruction in Bavaria. He became one of the advisers of the Minister of the Interior in 1845, and three years later he served as Munich representative in the Frankfort Assembly. Here he led the forces opposed to the threatening leadership of Prussia. In 1855 Hermann was made Councilor of State and for a time was also in charge of the Bureau of Statistics. He published important pamphlets as head of this bureau, and is now regarded as one of the foremost pioneers in the field of statistics. His reputation as an economist is founded on his 'Staatswirtschaftliche Untersuchungen' (1832).

HERMANN UND DOROTHEA. Goethe's 'Hermann and Dorothea' is a bright idyll of a small German country town near the right bank of the Rhine, set against the dark background of the French invasion of the Rhenish

Palatinate in 1794. It was written between September 1796 and March 1797, and was to some extent suggested by Voss's 'Luise,' an idyll in hexameters, first published in 1782–84. The story of the well settled burgher's son marrying a poor fugitive was contained in an account of the Salzburg Protestants who, for their religion, in 1731 fled from their old homes into Germany. The inhabitants and conditions of the little town which is the scene of 'Hermann and Dorothea' are pictured in contrast to the turmoil of the French Revolution, for they stand for the foundations on which civilization will always rest. The leading characters represent the standard callings of men — the farmer, the merchant, the apothecary-doctor, the minister, the judge. The hero is the true son of mother earth, given to tilling the soil and harvesting his crops. The life both in family and community is depicted as the fundamental social forms, with some hints of national life. The love story of the young couple is free from wild romance, indeed their love makes them look to the future not with any anticipation of pleasure or extravagance, but with the instinctive conviction that the true blessings of life flow from the performance of necessary tasks. The public spirit of Hermann's father germinates also in the son's character as his burning patriotism protests against the French invasion. But the spirit that permeates the poem as a whole is that of trust in the future and sympathy with mankind. The hexameters of the nine cantos are at times irregular. The serene flow of presentation, the masterly descriptions of landscape and home, the plastic vigor of the main figures, the balance of color, all go to render 'Hermann and Dorothea' a great work of literary art. Consult edition of Goethe's works in 'Deutsche National-Literatur' (Vol. V, pp. 1–99, 1882–98); English translation in German classics and in Harvard classics; von Humboldt, W., 'Æsthetische Versuche: Hermann und Dorothea' (1799); Hehn, V., 'Ueber Goethes Hermann und Dorothea' (1893).

Ewald Eiserhardt.

HERMANN, Mo., a town in Roark Township, the capital of Gasconade County, on the south bank of the Missouri River, here crossed by a bridge, 81 miles west of Saint Louis, and on the Missouri Pacific Railroad. It is in a grape-vine-growing region and manufacturers wine, beer, flour, tools and cigars. Pop. 1,700.

HERMANNSTADT, or NAGY-SZEBEN, Austria, the capital of a county in Transylvania. See Szeben, Nagy.

HERMAPHRODITISM, the occurrence of both kinds of sexual glands in one and the same animal. The differentiation of the sexes begins with the polyps, when for the first time in the animal kingdom we meet with individuals which are male and female. The lower plants and in the animal kingdom the sponges and Hydra (q.v.) are monœcious, that is, sexual cells occur in the same individual. In the more highly specialized animals, the sexual glands exist in different individuals, and the form is said to be bisexual, or diœcious, as opposed to hermaphroditic forms.

True or Natural Hermaphroditism.— This is found in many flowering plants, in sponges, most cœlenterates, many worms, including the earthworm, many mollusks and in most barnacles, and this appears to be in relation with their more or less fixed mode of life. As a rule testes and ovaries occur in the same animal, but situated in different regions of the body, while in land snails there is a hermaphroditic gland which produces spermatozoa and eggs in the same follicle. Certain animals, or frogs, which are bisexual as adults, pass through an embryonic hermaphroditism. Normal hermaphroditism is very rare in insects and vertebrates; in the latter only two cases are known, that is, a sea-perch (*Serranus scriba*) and the hagfish (*Myxine*).

Abnormal Hermaphroditism.— What in man is called hermaphroditism is a misnomer, as it arises from malformation of the external reproductive organs. In insects occurs lateral hermaphroditism in which one-half of the moth or butterfly, for example, is male and the other female. In some of these cases dissection has shown that only male or female sexual glands alone occur in an undeveloped condition. This is called *gynandromorphism*. Abnormal hermaphroditism sometimes occurs in fishes and batrachians where an ovary is found on one side and a testis on the other. It is curious that in a threadworm (*Angiostomun*) and in certain isopod crustacea (*Cymothoidæ*) the reproductive glands are first male, the same gland afterward producing eggs.

HERMAS, Shepherd of, the traditional author of an early Christian work, so called because of the character and title of the angel by whom most of the revelations are made. Authorities disagree as to the identity of the author and date. Each theory presents difficulties, but it is quite probable that the authorship is divided, or else that frequent revisions and editions were made before the work reached the form in which it has come down to us. The work includes five 'Visions'; 12 'Mandates' and 10 'Similitudes.' It is interesting chiefly in its bearing on the circumstances in which early Roman Christianity flourished. In doctrine, it is thoroughly Christian, but lays emphasis on the ethical, rather than the dogmatic, points of the religion. It has often been included in earlier editions of the New Testament, but lost prestige in about the 4th century. There are three defective ancient manuscripts of the Hermas in Greek. The best modern edition is by Harnack and Gebhardt (Leipzig 1877). Harmon published a later one with an English translation by Lightfoot (London 1893). K. Lake produced 'Facsimiles of the Other Fragments of the Shepherd' (New York 1907). Consult Spitta, 'Zur Geschichte und Litteratur des Urchristentums' (Vol. II, 241–437, Göttingen 1896); Taylor, 'The Shepherd of Hermas' (New York 1901).

HERMENEUTICS, the study of or instruction in, the science and art of interpreting the Scriptures. See Exegesis.

HERMES, hĕr'mĕs, **Georg,** German theologian: b. Dreyerwalde, Westphalia, 22 April

1775; d. Bonn, 26 May 1831. He studied theology at the University of Münster, became a teacher in the gymnasium of that city, and in 1807 professor of dogmatic theology in the university. When the Prussian government established the University of Bonn, Hermes was appointed to the chair of Catholic theology (1819). Here he began to distinguish himself by his attempts to found a speculative, philosophic and dogmatic school in the Church itself, delivering a series of lectures which caused great sensation by aiming at an alliance between Protestants and Catholics. This attempt to base the positive theology of the Church (a doctrine known as Hermesianism) drew around him great numbers of followers. Many of these in time filled chairs of theology and set forth their views in conjunction with their master in a magazine, the *Zeitschrift für Philosophie und katholische Theologie*, published at Cologne from 1832. The method which Hermes advocated insisted that the truth of revelation and of the Catholic Church should first be tested by reason, and that revelation should then be followed. He did not go so far as to declare that all the dogmas in themselves could be proved a priori, but endeavored to found the right of the Church to teach them on the ground of reason. Hermesianism was in fact an ingenious effort to base the doctrines of the Church on Kant's system of philosophy. It aroused powerful opposition, being condemned as heretical by a papal letter of 26 Sept. 1835. Hermes' scholars stoutly defended their orthodoxy, many of them repeatedly appealing to the Pope, on the ground that the Pope had been misinformed by persons who were ignorant of philosophy and theology alike. The Hermesians admitted that the doctrines specified in the papal brief were heterodox, but alleged that these were not the doctrines of Hermes. The chief adherents of the new school were the professors Braun, Elvenich and Achterfeldt. Hermesianism declined rapidly, however, and by 1850 had become a matter of history. Hermes wrote ‘Ueber die Warheit des Christentums’ (1805); ‘Einleitung in die christkatholische Theologie’ (2 parts, 1819–29); ‘Christkatholische Dogmatick’ (1834). Consult Braun and Elvenich, ‘Acta Romana’ (Hanover 1838); Lichtenberger, ‘German Theology in the Nineteenth Century’ (Edinburgh 1889); Niedner, ‘Philosophiæ Hermesii Explicatis’ (Leipzig 1838); Werner, ‘Geschichte der katholischen Theologie’ (Munich 1866), and the biography by Gla in ‘Repertorium der katolisch-theologischen Literatur’ (Vol. I, Paderborn 1904).

HERMES, hėr′mēz (called by the Romans *Mercurius*, and identified with their own god of that name), in Greek mythology the son of Zeus and Maia. According to legend his birthplace was in the mountains of Cyllene, Arcadia. Four hours after his birth he invented the lyre, which he made by killing a tortoise and stringing the shell with three or seven strings. He then sang to it the loves of Zeus and his mother, Maia. Having concealed the lyre in his cradle, he was seized with hunger, went in the dark evening to Pieria, and stole 50 oxen from the sacred herd of Apollo which he drove backward and forward to confound their tracks; then walking backward himself, he drove them backward also; and after having killed two of them near the river Alpheus, roasted and sacrificed a part to the gods. He concealed the remainder in a cavern. He also carefully destroyed all traces of them. The next morning Apollo missed his oxen and went in search of them, but he could discover no traces of them until an old man of Pylos told him that he had seen a boy driving a herd of oxen in a very strange manner. Apollo now discovered that Hermes was the thief. He hastened to Maia and accused the infant, who pretended to be asleep and, not terrified by the threat of the god that he would hurl him into Tartarus, steadily maintained his innocence. Apollo, not deceived by the crafty child, carried his complaint to Zeus. Hermes lied even to him. Zeus perceived him to be the offender, but was not angry with him, and smiling at his cunning, ordered him to show the place where the oxen were concealed. To secure him Apollo bound his hands, but his chains fell off, and the cattle appeared bound together by twos. Hermes then began to play upon his newly-invented lyre, at which Apollo begged the instrument of the inventor, learned of him how to play on it and gave him a whip to drive the herd, thenceforth belonging to both in common.

They then concluded a compact with each other; Hermes promised never to steal Apollo's lyre or bow; the latter gave him the *caduceus*. The ancients represent Hermes as the herald and messenger of the gods. He conducts the souls of the departed to the lower world, and is therefore the herald of Pluto and the executor of his commands. His magic wand had the power to close the eyes of mortals, to cause dreams and wake the slumbering. The qualities requisite for a herald he possessed in the highest perfection, and bestowed them on others — grace, dignity and insinuating manners. He was also the symbol of prudence, cunning and fraud, and even of perjury, and was the god of theft and robbery. In the wars of the giants he wore the helmet of Pluto, which rendered him invisible, and slew Hippolytus. When Typhon compelled the gods to fly before him and conceal themselves in Egypt, he metamorphosed himself into an ibis. He is also mentioned by Homer as the patron of eloquence, and still more particularly by Hesiod. Of his inventions Homer makes no mention. Later writers ascribe to him the invention of dice, music, geometry, the interpretation of dreams, measures and weights, the arts of the palæstra, letters, etc. He was also regarded as the patron of public treaties, as the guardian of roads and as the protector of travelers. He was represented in art as a boy in the prime of youth, sometimes with the caduceus, and sometimes with a winged cap, standing, sitting or walking. The artists of later times placed him among the youthful and beardless gods. The most prominent traits of his character are vigor and dexterity. In the representation of Hermes of a later date the relations of corporeal beauty and mental dexterity are wonderfully preserved. Artists made the cock his symbol, on account of its vigilance or love of fighting (in allusion to gymnastics); the tortoise, on account of his invention of the lyre; the purse, because he was the god of traffic; a ram and a goblet, because he was the director of religious ceremonies and sacrifices; the trunk of a palm-tree, upon which his statues lean, because he was the inventor of arithmetic and writing (upon palm-leaves); the *harpe* or sickle-shaped knife, because he was the slayer of Argus. Consult Lang, Andrew, 'Myth, Ritual and Religion' (1887); and Farnell, 'Cults of the Greek States' (Vol. V, 1909). See Greek Gods.

HERMES TRISMEGISTUS, tris-mĕ-jĭs'tŭs, the Greek title of the Egyptian moon god, Thoth, one of the most interesting figures in Egyptian mythology. He is represented as Ibis or with the ibis head, and is fully illustrated in the monuments and papyrus rolls from time to time brought to light. He is the god of time and of its divisions; he is the measurer and the god of measurements. He is the conductor of the dead. He is also the god of human intelligence, to whom are attributed all the productions of human art. All the literature of Egypt is attributed to him — all the writings that relate to the different sciences, mathematics, astronomy, medicine, music. These were called by the Greeks the Hermetic Books. Thoth is also credited with the invention of alchemy and magic. The Hermetic art is used to mean alchemy. The secrets of this art were handed on from teacher to pupil orally and in secret and this transmission was termed the Hermetic chain. For these reasons the Greeks identified him with their Hermes, and besides called him Trismegistus, "Thrice great." By later writers, Euhemerists, Neoplatonists (q.v.) and Christians, Thoth was considered a great Egyptian king, a teacher of mankind, who had left books of magic and mystery behind him. Numerous books of such a sort once existed in Egypt. Clement of Alexandria knew of 42, and so-called Hermetic fragments are still extant, in the works of Stobæus, Cyrillus, Suidas and Lactantius. The Hermetic books as we know them belong probably to no earlier date than the 3d or 4th century of our era and are in Greek and Latin. Consult Mead, G. R. S., 'Thrice Greatest Hermes' (1907).

HERMETIC LITERATURE. See Hermes Trismegistus.

HERMIT (Gr. *eremitēs*), a solitary ascetic, who with a view to more complete freedom from the cares, temptations and business of the world took up his abode in a natural cavern or a rudely formed hut in a desert, forest, mountain or other solitary place. Hermits began to appear in the Christian Church in the 3d century. The advocates of asceticism (q.v.) were the first to set the example of retiring from cities to rural districts and villages. But the hermits sought to withdraw altogether from mankind, that they might give themselves up to holy contemplation. The earliest hermit is said to have been Paul of the Thebaid (Egypt), who during the Decian persecution fled to the desert (250); there he lived for the rest of his life, dying, 113 years old, about 342. The fame of his sanctity quickly incited others to imitate his mode of life. The most famous amongst these successors was Saint Anthony (q.v.). At the time of his death (365) hermit cells existed in considerable numbers in the deserts of Egypt, Syria and Palestine. The fame of their sanctity drew many to visit these hermits partly out of curiosity to get ghostly counsel from them, partly also in the belief that diseases were cured by their blessing. Sometimes they returned for a short time to the midst of their fellow-men to deliver warnings, instruction or encouragement, and were received as if they had been inspired prophets or angels from heaven. But the number of hermits gradually diminished as the cenobite life of convents grew into fashion. Indeed the institution at no time secured the same footing in the Western Church that it did in the Eastern; and perhaps the reason may in part be found in the difference of climate, which renders a manner of life impossible in most parts of Europe that could be pursued in Egypt or Syria. Partial revivals of the practice continued to be made, however, during some centuries, Saint Cuthbert (q.v.) being a case in point. (See Monachism). Consult Charles Kingsley's 'Hermits' (1869).

HERMIT-CRABS, crabs that shelter themselves in spiral sea-shells, for the protection of the soft-skinned and unsymmetrical abdomen. They are members of the *Macrura* (see Decapoda), and have very large and generally unequal claws, one being used to close the entrance of the shell into which the hermit can wholly retract himself. The abdominal appendages are practically aborted, with the exception of those at the tip of the tail, which hold firmly to the spire of the inhabited shell. The hermit-crabs belong to three families, namely: *Paguridæ*, or common marine hermit-crabs; *Parapaguridæ*, or deep-sea hermit-crabs; and *Cenobitidæ*, or terrestrial hermit-crabs. Two species are numerous on the American Atlantic coast running actively about in rock pools and shallows. The little hermit-crab (*Eupagurus longicarpus*) generally inhabits the shells of dog-whelks (*Ilyanassa*), while the larger species (*E. pollicaris*) occupies those of *Lunatia* or sometimes of the wrinkles and conchs. As they grow they must move to larger and larger shells, and the search for new tenements and dangerous change of abodes in the presence of enemies makes the life of one of these animals more than ordinarily exciting. The habits of these and other hermit-crabs are of great interest, generally, and especially on account of the various hydroids, anemones and mollusca which associate with them as commensals. The palm or robber-crab (q.v.) of the East Indies, and the land-crabs of the West Indies, are good examples of terrestrial hermit-crabs. Consult Henderson, J. R., 'Challenger Report on Anomura'; Verrill, 'Invertebrates of Vineyard Sound' (1875); Arnold, 'Sea Beach at Ebb-tide' (1901). See Commensalism; Crab; Crustacea.

HERMIT THRUSH. See Thrush.

HERMITAGE, The. Andrew Jackson's home at Nashville, Tenn., from about 1804, when he removed there from Hunter's Hill. In 1819 the house was built in which he lived till his death in 1845. The Hermitage is now the property of the State of Tennessee.

HERMITE, ār-mēt, **Charles,** French mathematician: b. Dieuz, Meurthe, German Lorraine, 24 Dec. 1822; d. Paris, 14 Jan. 1901. He entered the École Polytechnique in 1842, but left it to devote his attention wholly to mathematics. He taught at the École Polytechnique from 1848 to 1876 in various capacities, also acting as lecturer at the École Normale Supérieure from 1862 to 1873. From 1876 to his death he held the chair of higher algebra in the University of Paris. His principal claim to be considered a great and original mathematician rests on his investigations in the line of functions, and his first important work on this theory won for him election to the Academy of Sciences. He proceeded to make discoveries in the theory of algebraic forms and in the theory of numbers. He finally settled the question of the solubility of the quintic equation, and really led the way to Lindemann's further investigations. He became a Grand Officer of the Legion of Honor and a member of the Academy of Sciences in 1892. For a list of his writings consult 'Catalogue of Scientific Papers of the Royal Society of London' (Vols. III and VII); also Mittag-Leffler and Picord in 'Acta Mathematica' (Vols. XXIII and XXIV, Stockholm 1901–02); and Darboux, G., 'Notice historique sur Charles Hermite' (Paris 1905).

HERMOGONES, hėr-mŏj,ĕ-nēz, Greek rhetorician, who lived about 170 A.D., a native of Tarsus. At an early age he showed marked ability in forensic and in lecturing, and at the age of 17 was appointed an instructor in oratory by Marcus Aurelius. His 'Manual of Rhetoric,' which was evidently published for the benefit of his pupils, remained for a long time the standard work on the subject. A considerable fragment of this work, dealing with oratorical precepts, has survived and has been published by Walz in 'Rhetores Græci' (Stuttgart 1832–36), and Spengel, 'Rhetores Græci' (1853–56). Hermogones' faculties seem to have suffered from his great precocity and at the age of 25 they snapped under the strain, and he produced no further work.

HERMON, Mount, a lofty mountain in Syria, on the border of Palestine, the southernmost peak of the chain of Anti-Libanus. It is about 9,050 feet high. Snow caps the summit throughout the year, but the lower slopes bear rich vegation, chiefly grapes and fruit. Little Mount Hermon, bounding the plain of Esdraelon on the east, is 25 miles southeast of Acre, and was called Mount Hermon in the geography of the Middle Ages. The name in Hebrew signifies "forbidden," implying that a sanctuary or holy place was once located there.

HERMOSILLO, hăr-mō-sēl'yō, Mexico, capital of the state of Sonora, on the river Sonora, about 60 miles from the Gulf of California and 78 by rail north from the port of Guaymas, with which it has a large traffic, being the principal entrepôt for the trade with the interior. Large quantities of fruit are grown in the vicinity, especially grapes, from which much brandy is made.

HERNÁNDEZ DE CÓRDOBA, Francisco, Spanish soldier and explorer: b. about 1475; d. Leon, Nicaragua, March 1526. In 1514 he went to Panama with Pedrarias and was sent by him to take possession of Nicaragua. He founded Granada, Leon and other towns, and discovered the outlet of Lake Nicaragua. He was afterward accused of disloyalty in trying to set up an independent government and was seized by Pedrarias and beheaded.

HERNÁNDEZ Y GIMENO, Pablo, Spanish author and priest of the Society of Jesus: b. Rubielos de la Cérida, Teruel, Spain, 9 Oct. 1852. He was educated at the Seminary of Saragossa and at Jesuit scholasticates in France and Spain. In 1872 he entered the Jesuit Order and from 1877 to 1880 was professor of Latin grammar at a Jesuit scholasticate in Chile. From 1880 to 1885 he was professor of science in a Jesuit college in Argentina, and in the latter year returned to Spain. In 1888 he was ordained to the priesthood; taught philosophy at Valencia, 1889–90; scholastic philosophy, 1890–93; and Scripture, 1894, in various scholasticates in Spain. In 1894–96 he was professor of physics, zoology and mathematics in the College of Our Savior, Buenos Aires; in 1896–98 taught theology and canon law in the Seminary of Buenos Aires, and from 1898 to 1903 assisted Rafael Pérez in writing his 'Historia de la Compañiá moderna la Argentina y Chile.' For the next seven years he assisted Father Astrain with his 'Historia de la Asistencia de España.' In 1912–13 he was a member of the editorial staff of the periodical *Razón y Fe.* He has written 'Judicio critico de la educación antigua y la moderna' (1886; 1888); 'El extranamiento de los Jesuitas del Rio de la Plata y de las misiones del Paraguay' (1908); 'Los Jesuitas en el Río de la Plata: Historia del Paraguay' (4 vols., 1910–13), a translation of Muriel's 'Historia Paraguajensis.' He edited Cardiel's 'Declaración de la verdad' (1900); 'Organización social de las doctrinas Guaranies de la Compañia de Jesús' (2 vols., 1913). He is a contributor to *Razón y Fe Revista eclesiástica del Arzobispado de Buenos Aires; Amigo del Clero* of Lima; *La Revista eclesiástica* of Santiago, Chile, 'Reseña Histórica de la Misión de Chile-Paraguay, 1836–1914' (1914); and 'El P. Francisco Suárez, S. I.' (1917).

HERNANI, by Victor Hugo, is an epoch-marking play in the history of French drama. Finished in September 1829, eagerly accepted by the committee of the Théâtre Français in October, it was found so radical in its departure from French dramatic traditions, both in structure and in versification, that intense opposition to it developed among actors and dramatic journalists, so that its first performance, 25 Feb. 1830, became a sort of pitched battle between the classicists and romanticists, the conservatives and the innovators. Gautier in his 'Histoire du romantisme' has given the classic account of this memorable struggle in which he bore the most conspicuous part. It extended through 45 performances. Almost every line had been at some time applauded or hissed, four parodies had appeared in as many Parisian theatres, before it was withdrawn. Victory rested with the radicals, but rather for the cause than for the drama. 'Hernani' is still occasionally acted, but its merits are lyric rather than dramatic. It has many passages of great strength and some of striking beauty, but it lacks unity of action and is continued beyond a satisfying conclusion. The time of the play is 1519. It opens and closes at Saragossa. The third act is in the mountains of Aragon, the fourth at Aix-la-Chapelle. The story has no historical basis, though historical incidents and personages are skilfully involved in it. Doña Sol, the heroine, niece of Don Ruy Gomez de Silva, is beloved by him, by Don Carlos, king of Spain, and by Hernani, bandit pretender to the throne. The king favors her marriage with Gomez; she favors Hernani. The three rivals, fanatically devoted to ideals of Castilian honor, spare and protect one another. Gomez even suffers the king to take Doña Sol from his castle on the appointed wedding day rather than give up Hernani, his uninvited guest. Hernani, pledging his own life to his rival's command, enlists him in a conspiracy to defeat the election of Carlos as emperor. Carlos, triumphing, gives Doña Sol to Hernani. Gomez, recalling Hernani to his pledge, bids the bridegroom drink the poison he has prepared. Doña Sol shares it. Gomez kills himself. The play's finest passages are the monologue of the newly-elected Emperor Charles V (Act 4, Sc. 2), the closing love and death scenes (Act 5, Sc. 3 and 6) and the portrait scene at the castle of Gomez (Act 3, Sc. 6). 'Hernani' is edited with English notes by Matzke (1893), Harper (1891) and Perry (1888), Consult Le Roy, 'L'Aube du théâtre romantique' (1904), and for contemporary criticism Biré, 'V. Hugo avant 1830,' pp. 489–508. Translations in Vol. I of 'Dramas by V. Hugo' (Boston 1903), and in 'Dramatic Works of V. Hugo' (London 1913).

BENJAMIN W. WELLS,
Author of 'Modern French Literature.'

HERNDON, William Henry, American lawyer: b. Greensburg, Ky., 28 Dec. 1818; d. near Springfield, Ill., 18 March 1891. He studied at Illinois College, was admitted to the bar in 1844 and in the same year formed a law partnership with Abraham Lincoln, which continued formally till the latter's death. He was mayor of Springfield, Ill., in 1855. With J. W. Weik, he wrote the well-known 'Herndon's Lincoln: The True Story of a Great Life' (in a new ed. 1891), which is particularly valuable for the study of Lincoln's personality and the details of his early career.

HERNE, James A. (JAMES AHERNE), American actor and playwright; b. Troy, N. Y., 1 Feb. 1840; d. New York, 2 June 1901. He first appeared in a traveling company and later in various rôles and organizations throughout the United States. Later he was actor-manager at San Francisco and in 1878 presented his first play, 'Hearts of Oak,' which won immediate success. 'Drifting Apart' (1885), 'The Minute-Men' (1886) and 'Margaret Fleming' (1890) were less favorably received, although the last was highly ranked by the critics. In 1883–84 Herne wrote his most successful work, 'Shore Acres,' which was first performed as 'The Hawthornes' at Chicago in 1892, and in 1892–93 in Boston under its present title. He himself appeared as «Uncle Nat» Berry. 'Shore Acres' was followed by 'The Rev. Griffith Davenport' (1899), a dramatization of Helen Gardner's 'An Unofficial Patriot' and 'Sag Harbor' (1900). As both actor and dramatist Herne was a skilful delineator of types of everyday life.

HERNIA (Latin, a rupture, a burst, a descent), a swelling formed by the displacement of a soft part, which protrudes by a natural or accidental opening from the cavity in which it is contained. The three great cavities of the body are subject to these displacements. The brain, the heart, the lungs and most of the abdominal viscera may become totally or partially displaced, and thus give rise to the formation of hernial swellings. Displacements of the brain and of the organs of the chest are, however, extremely rare, and are in general the result or symptom of some accident or disease. They are frequent in war times from gun-shot wounds and from the necessary surgical procedures. Many parts of the abdominal wall may become the seat of hernias, but they most commonly appear in the front lower regions, which, being destitute in great measure of muscular fibres, and being the site of many of the openings leading from the abdomen to the limbs, offer less resistance to the displacement of the viscera. Hernias are most common in the groin, at the navel, more rarely in the vagina, at the interior and upper part of the thigh, and at its lower and posterior part. They have received different names from their positions. All the abdominal viscera, with the exception of the duodenum, the pancreas and the kidneys may form a hernia, but they are not all displaced with the same facility. The omentum and intestinal canal escape easily; the stomach, liver and spleen rarely form hernias. Most of the viscera, when displaced, push the peritoneum forward before them; this membrane thus forms a covering to the hernia, which is called the hernial sac. If the hernia, with its sac, can be entirely replaced, it is said to be reducible; if, from its size or other cause, it cannot be restored to its former place, it is irreducible.

Among the predisposing causes of hernia may be ranked any circumstance which diminishes the resistance of the abdominal walls, whether natural or accidental; such as muscular weakening of those walls by a forced distension, as in pregnancy, by accidents, by lifting heavy weights or by excessive standing. Any prolongation of the viscera which tends to bring them in contact with points at which they may protrude, and articles of dress which push the organs toward the weaker parts of the abdominal wall (as corsets), may also produce hernia. The efficient causes of hernia are all circumstances which may break the equilibrium existing between the abdominal walls and the viscera, which react and mutually press upon each other. The simultaneous contraction of the abdominal muscles and of the diaphragm, which takes place on every violent effort, is one of the chief of these cases. Hence sneezing, coughing, leaping, playing on wind-instruments, etc., may be the direct cause of hernia.

The symptoms of a hernia are the existence of a tumor or swelling at any point of the abdomen, but more particularly in the region of the groin. A reducible hernia is not a very troublesome disease, but may become so by acquiring an increase of size, and by strangulation. A hernia is said to be strangulated when it is not only irreducible, but also subjected to a continual constriction; this constriction may be produced by different causes, but it is generally a constriction at the opening through which the hernia protrudes. As soon as a patient perceives that he is affected with a hernia he should have recourse to medical advice, for the disease is then in its most favorable state for treatment. The hernia is immediately reduced, and must then be subjected to a constant compression. This is done by means of a truss (q.v.). An irreducible hernia must be supported with great care. All violent exercises and excess in diet must be avoided. Strangulated hernia, presenting greater danger, requires more prompt relief. The object of treatment is to relieve the constriction. If the reduction cannot be effected by other means, an operation will be necessary. This consists in dividing the parts which produce the constriction. The longer this operation is delayed, the more dangerous it will become. After the parts are healed, the opening must be subject to compression, as in the case of a simple hernia. Radical operation for hernia is the most advisable form of treatment. It is safe in the hands of a competent surgeon.

HERO, a priestess of Aphrodite at Sestos. The loves of Hero and Leander, a youth of Abydos, on the other side of the Hellespont, are related in a poem by Musæus. No difficulties could discourage Leander. He swam every night across the Hellespont, guided by a torch which shone across the strait from the tower of Hero, and even continued his visits during the winter. On one occasion, however, the guiding light was extinguished and his strength failed him, and the waves carried his body to the foot of the tower, where Hero anxiously awaited him. Overcome with anguish at the sight, she threw herself from the tower and perished.

HERO OF ALEXANDRIA (Gr. *Herōn*), Greek mathematician and natural philosopher: fl. perhaps in the 1st century A.D. He seems to have invented a number of machines, among which are «Hero's fountain» and a steam engine on a principle similar to that of Barker's mill (q.v.). He also made some contributions to pure mathematics. Hultsch edited the remaining fragments of his geometrical works in 1864 and Schmidt began in 1899 an edition of his complete extant writings. See HERO'S FOUNTAIN.

HERO AND LEANDER, one of the world's unforgotten stories of ill-fated love, probably began as a legend of Sestos and Abydos on the Hellespont, in explanation of some immemorial local cult of swimmer, torch and tower. Its literary possibilities may have attracted a poet — perhaps Callimachus — at Alexandria, where many such ætiological legends were versified; and his poem, now lost, seems to have taken the tale to Rome. Leander is the one human example cited by Virgil ('Georgics' iii 258ff.) in proof of the irresistible might of desire. Ovid invents two of the lovers' letters ('Heroides' xviii and xix) tricked out with sentiments, «points,» verbal quips, and rhetorical conceits and antitheses in the right Alexandrian vein. There are allusions in Statius ('Thebaid' vi 542ff.) and other ancient authors. It is Musæus («Grammaticus»), however, an otherwise unknown poet of the 5th or 6th century A.D., who in a poem of 341 Greek hexameters gives the tale its decisive form for literature. From the lovers' first meeting in the temple of Aphrodite the narrative proceeds through Leander's nightly swimmings of the Hellespont until in a night of storm Hero's torch and Leander's life are extinguished together and Hero perishes at morning upon his corpse. Though tinged with rhetoric, though indeed sharing with Ovid's 'Heroides' several conceits which may point to a common source in the hypothetical Alexandrian version, Musæus's poem has passages of fine imagination and of true pathos: the end especially has been left unlabored, with something of the old Greek reserve. The Renaissance (editio princeps, 1484, Aldus) assumed the author to be that early semi-mythical Musæus who is associated in legend with Orpheus and Linus. Uncritically accepting as primitive the work of a post-classical grammarian, it proceeded to emphasize the Ovidian or Alexandrian traits of his poem. Marlowe's unfinished 'Hero and Leander' (published 1598 with an ending by Chapman) retains Musæus's scenario, but expands his simple speeches and brief imagery into passionate tirades and long voluptuous descriptions. Chapman, at once more Puritanical and more «conceited,» is stodgily concerned for the legality of the lovers' marriage, sermonizes about their passion, adds episodes, allegories, emblems, and other irrelevancies, and ends by metamorphosing the lovers into birds.

Chapman also made a faithful and complete translation of Musæus (1616; reprinted 1858); other English translations are by Sir Robert Stapylton (1647), the Rev. Francis Fawkes (1789), and Sir Edwin Arnold (1888). There are poems and extended allusions by Byron, Keats, Leigh Hunt, Moore, Hood, Rossetti, and Tennyson, a ballad by Schiller, and a five-act tragedy by Grillparzer. Consult Rohde, Erwin, 'Der griechische Roman und seine Vorläufer' (Leipzig 1914); Palmer, Arthur (ed.), 'Ovid's Heroides' (Oxford 1899); Jellinek, M. H., 'Die Sage von Hero und Leander in der Dichtung' (Berlin 1890); Chabalier, Léonce, 'Héro et Léandre' (Paris 1911).

SAMUEL LEE WOLFF.

HERO OF OUR TIME, A ('*Geroy nashego uremeni*'). Lermontov intended to represent Pechorin, the «hero» of this novel, as a type of cultured men of the thirties, by taking himself as a partial example of that class. His obligation to Pushkin's *Eugeni Onyegin* is expressed in the very name of the chief character, which is derived from the river Pechora, as Pushkin derived his from the river Onyega, wherefore the critic Byelinski said that the two characters did not differ from each other more than did these two rivers. Pechorin is a blasé, but in contradistinction to Onyegin he is filled with ambition and the love of power. He spurns the official career, which alone was then open to men of the upper classes, and directs all his energies to the conquest of women's hearts. In the thirties the critics dwelt on the reflective sides of Pechorin, his melancholy, introspection and despair; that is, they saw in him a member of the Byronic crew, so numerous in the literatures of that period. But, in the light of the later, more positive evolution of the intellectuals in Russia, the modern critics point out the fact that Pechorin belongs to the class of unsuccessful, useless men who made social progress impossible. They look upon him as a literary specimen illustrating certain psychopathological defects common to men of the first half of the 19th century.

The novel contains also a series of positive characters, such as the mountaineers who are untouched by civilization and the simple-minded, faithful Maksim Maksimich and Bela. All these are described with rare accuracy and are totally devoid of melodramatic characterization. It is chiefly the romantic element of the novel in its exotic setting in the Caucasus that has attracted the Western readers to it, hence the considerable number of translations, especially in English, where we have the abbreviated ones by Theresa Pulszky (London 1854), by R. I. Lipmann (London 1887), and by J. H. Wisdom and Marr Murray, 'The Heart of a Russian' (London 1912, and New York 1916); and the anonymous ones, 'Sketches of Russian Life in the Caucasus' (London 1853), and 'A Hero of Our Own Times' (London 1854).

Leo Wiener.

HEROD, called the Great, king of the Jews: b. about 62 B.C.; d. 4 B.C. He reigned from 37 B.C. until his death. He was the second son of Antipater the Idumean, who, being made procurator of Judea by Julius Cæsar, appointed him to the government of Galilee. He as first embraced the party of Brutus and Cassius, but after their death reconciled himself to Antony, by whose interest he was first named tetrarch and afterward king of Judea. After the battle of Actium Augustus confirmed him in his kingdom. As a politician and commander, his abilities were conspicuous. He rebuilt the temple at Jerusalem with great magnificence and erected a stately theatre and amphitheatre in that city, in which he celebrated games in honor of Augustus, to the great displeasure of the more zealous of the Jews. He also rebuilt Samaria, which he called Sebaste, and adorned it with very sumptuous edifices. He likewise, for his security, constructed many strong fortresses throughout Judea, the principal of which he termed Cæsarea, after the emperor. On his palace, near the temple of Jerusalem, he lavished the most costly materials, and his residence of Herodium, at some distance from the capital, by the beauty of its situation drew around it the population of a great city. Such, indeed, was his magnificence that Augustus said his soul was too great for his kingdom. Herod was the first who shook the foundation of the Jewish government, by dissolving the national council, and appointing the high-priests, and removing them at pleasure, without regard to the laws of succession. His policy, ability and influence with Augustus, however, gave a great temporary splendor to the Jewish nation.

HEROD. The tragic figure of Herod the Great is one of the favorite traditions of literature. History tells us that he was ambitious. Josephus in his 'Antiquities of the Jews' (xv), tells of his tragic love for Mariamne, his wife, but makes no reference to the Gospel story of the massacre of the Innocents. In the 5th century Macrobeus accepts some features of the biblical narrative and augments them by telling that two of Herod's own children were lost in the massacre. Modern writers, among whom were Alexander, Hardy, Voltaire and Hebbel have used such strains of the story as pleased them. In the miracles of the Middle Ages Herod was a ranting figure whose excesses explain Hamlet's words "out-Herod's Herod." In writing his version of the Herod story for the first year of the 20th century Stephen Phillips places greatest weight on the great king's infatuation for his wife and fear of losing his kingdom. The victim of Herod's murderous intrigue is in his play the young brother of Mariamne, Aristobulus. By means of this shift in characters the poet was able to combine the two strains of the Herod tradition. The ingenuity the playwright displays in the handling of his situation is equaled by the dramatic skill with which the story is put forth on the stage. The play is vigorous, crisp and poetic. Herod is a bluff and sympathetic figure. The love passages between Herod and Mariamne offer some of the rarest poetry of the modern theatre. They are full of dramatic prescience. Before writing plays in verse for the modern stage Phillips had been benefited by two types of experience. He had made himself a distinguished poet and in the traveling troupe of his cousin F. R. Benson he had secured abundant experience in the practice of the theatre in its more romantic and symbolic orders. Well as it reads Herod is in no sense a closet play. It was written for production. Its single scene, varying only by the change of light from morning to night and the placing and removal of a few stage properties, its effective use of the instruments of sight and sound, bespeak the experienced playwright. It is said that it was the poet's use of the sound of trumpets that decided Tree to accept the play for production. Though Herod is a great stage play it takes but a small place in the history of the modern English theatre. For some years reformers had been press-agenting a return to the poetic drama. George Alexander had in 1899 commissioned Phillips to write a play on the Paola and Francesca theme. Before this play could be produced and while it was in the height of its popularity in its published form Beerbohm Tree accepted and produced at His Majesty's Theatre, 31 Oct. 1900, the same poet's 'Herod.' The play did not have a long run. In 1909 the play was given a creditable production by Faversham at the Lyric Theatre in New York.

Thomas H. Dickinson.

HEROD AGRIPPA I, king of Judea: d. Cæsarea, 44 A.D. He reigned from 37 A.D. until his death. He was the son of Aristobulus and lived at Rome in extravagance until his debts made him retire to Idumea, but he returned some years after. On the accession of Caligula 37 A.D. he was honored with the title of king, and received the tetrarchies of Philip and Lysanias, and later that of Antipas. Upon the accession of Claudius his rule was extended to include all the dominions of Herod the Great. It was this Herod who, to please the Jews, caused Saint James to be put to death and Saint Peter to be imprisoned. His power and opulence acquired him a great reputation and he really did much for the benefit of the Jews. His death is described in Acts xii, 20–23.

HEROD AGRIPPA II, king of Judea: d. 100 A.D. He reigned from 53 A.D. until his death. He was son of Herod Agrippa I. He resided much at Jerusalem, and here, together with his sister, Berenice, heard the defense of Paul, addressed to the Roman governor Festus (Acts xxv, 13–xxvi, 32). A great builder, he improved his capital city of Cæsarea Philippi; renamed by him Neronias. It was in his reign that the Temple was completed. Being driven from Jerusalem in the revolt which proved so fatal to the Jews, he joined Cestius, the Roman commander, and, when Vespasian was sent into the province, met him with a considerable reinforcement. During the siege of Jerusalem he was very serviceable to Titus.

HEROD ANTIPAS, tetrarch of Galilee He reigned from 4 B.C. to 37 A.D. He was son of Herod the Great. This was the Herod who put to death Saint John the Baptist (Mark vi, 14–29), in compliment to his wife, Herodias, and it is he who is the familiar «Herod» of the New Testament narrative. Accused of having been concerned in the conspiracy of Sejanus, and of being in secret league with the king of Parthia, he was stripped of his dominions and sent (39 A.D.) with his wife into exile at Lugunum (Lyons) or, as some say, to Spain, where he died.

HERODES, Atticus. See Atticus Herodes.

HERODIADE, ā'rō'dyăd, a tragic opera in five acts by Jules Massenet, based on Flaubert's 'Herodias.' Originally produced at Brussels in 1881, in New Orleans 1892 and in London as 'Salome' in 1904. Though based on the biblical story the plot is different. The scene is laid in Jerusalem, about A.D. 30, and the principal characters are John the Baptist; Herod, king of Galilee; Herodias, his queen; Salome, who does not know that she is the daughter of Herodias; Phanuel, a young Jew; Vitellius, a Roman proconsul, and the High Priest. Salome enters the court of Herod's palace and tells Phanuel that she is seeking John the Prophet, who had saved her life when a child in the desert. Herod is in love with Salome; his wife demands the head of the prophet for having insulted her (Herodias), when John appears and denounces them both. They rush out, terrified; Salome now re-enters and confesses her love to John. Herod's mind is obsessed with thoughts of Salome while Herodias is jealously vigilant. The latter comes to Phanuel crying «Vengeance on the woman who has stolen Herod's love!» She asks Phanuel what had become of her long-lost daughter; pointing from a window he indicates Salome, who is entering the temple. In horror the queen exclaims, «My daughter? Never! She is my rival!» John has meanwhile been thrown into prison and Salome arrives exhausted with grief at the gate. Herod appears and passionately pleads his love; she rejects his advances and declares she loves another. Herod expresses his resolve to find out and kill his rival. John is tried and condemned by the priests; Salome falls at his feet imploring to die with him. Herod now understands, and decrees that both shall die. They are imprisoned together; John admits his love for her but urges her to leave him, which she refuses to do. She is dragged out by priests who convey her to the palace while John is led to his death. An imperial festival is being held in the great hall of the temple when Salome is brought in. She repeats her desire to die with her lover, appealing to the queen with the words, «If thou wert ever a mother, pity me.» Trembling at the word «mother,» Herodias appears to relent when the executioner appears and announces that the prophet is dead. With a furious cry Salome rushes to the queen and attempts to stab her, when Herodias cries, «Mercy! I am thy mother!» Horrified, Salome falls back, curses her mother and stabs herself. Some of the finest music of Massenet is to be found in this opera.

HERODIAS, a granddaughter of Herod the Great and Mariamne, daughter of Aristobulus and sister of Herod Agrippa I. She was first married to her half-uncle, Herod Philip, whom she abandoned to connect herself with his half-brother, Herod Antipas. It was by her artifice that Antipas was persuaded to order the death of John the Baptist (Matt. xiv, 3–12; Mark vi, 17–29).

HERODOTUS, Greek historian, called the «father of history»: b. at Halicarnassus in Asia Minor, about 484 B.C. Before writing his history he traveled extensively, visiting the shores of the Hellespont and the Euxine, Scythia, Syria, Palestine, Babylon and Ecubatana, Egypt as far as Elephantine and other parts of northern Africa, everywhere investigating the manners, customs and religion of the people, the history of the country, productions of the soil, etc. On returning home he found that Lygdamis had usurped the supreme authority in Halicarnassus and put to death the noblest citizens and Herodotus was forced to seek an asylum in the island of Samos. Having formed a conspiracy with several exiles he returned to Halicarnassus and drove out the usurper, but the nobles who had acted with him immediately formed an aristocracy more oppressive than the government of the banished tyrant, and Herodotus withdrew to the recently founded colony of Thurii, in Italy, where he seems to have spent most of his remaining life. Here, at an advanced age, we are told by Pliny, he wrote his immortal work, a statement strengthened by the fact that events are noticed in the body of the book which occurred so late as 409 B.C., while its abrupt ending proves almost beyond question that he was prevented by death from completing it. The history is divided into nine books, each bearing the name of a Muse, and is written in the Ionic dialect. The object of the historian is to narrate the conflict between the Greeks and Persians, and he traces the enmity of the two races back to mythical times. Passing rapidly over the mythical period he comes to Crœsus, king of Lydia, of whom and of his kingdom he gives a comparatively full history. The conquest of Lydia by Cyrus induces him to relate the rise of the Persian monarchy and the subjugation of Asia Minor and Babylon. The history of Cambyses and his Egyptian expedition leads him to introduce the valuable details of the history, geography and manners and customs of Egypt, occupying the second book. The Scythian expedition of Darius causes the historian to treat of the Scythians and the north of Europe; and the subsequent extension of the Persian kingdom affords him opportunity for an account of Cyrene and Libya. In the meantime the revolt of the Ionians breaks out, which eventually brings on the conflict between Greece and Persia. An account of this outbreak and of the rise of Athens after the expulsion of the Pisistratidæ is followed by what properly constitutes the principal part of the work, and the history of the Persian War now runs on in an uninterrupted stream until the taking of Sestos. There are English translations of his history by G. C. Macaulay (1890); Beloe, Cary, Macan and Rawlinson, the last with important notes and dissertations. The 'Life of Homer,' attributed to Herodotus, and printed at the end of several editions of his works, is now universally believed to be a production of a later date. The best editions of the history of Herodotus are by Wesseling (1763); Schweighäuser (1806); Bähr (1855–61); Stein (1871); and a notable commentary by How and Wells was published in 1912.

HEROES (*ἥρως* plu. *ἥρωες*) were men among the Greeks distinguished for exceptional strength, bravery or achievement. The etymology of the word has not been satisfactorily made out. It may be connected with a root that means «strong,» or one that signifies «to guard, protect,» either suggestive of soldierly qualities or attributes. (Cf. F. Deneken, in Roscher's 'Lexicon der Mythologie'). Other races cherish the memory of such outstanding figures, and by analogy the term is applied to them also. The heroes, whether of Hellas or elsewhere, belong invariably to an early age, before history records aught of their race; they live in the earliest form of that race's poetry, and draw thence an immortality in succeeding literature. They are often, rightly or wrongly — for there has been much written on the subject, — identified with myths and mythological beings; but their proper sphere is in legend, and as legendary characters they come down to us, except in the classical literatures, where they attain divine dignity analogous to that which the gods themselves enjoy.

Greek Heroes.— Among the Greeks in historical times the heroes were half mythological beings who enjoyed a distinct cult of their own. «What god, what hero, or what man (*τίνα θεὸν, τίν' ἥρωα, τίνα δ'ἄνδρα*) shall we resound?» asks Pindar in the beginning of the second Olympian ode, thus giving the heroes their hierarchic place between the Olympians and mortals. Hesiod ('Works and Days' 156–170) understands by heroes men of great renown, the fourth of the races of «speech-gifted men» whom the immortals created, and who lived — probably for but a few generations — between the brass age and his own, the iron age. They were the warriors celebrated in epic poetry and perished in the wars before the «seven-gated Thebes» and in the struggle for Helen at Troy; but they now dwell in the Isles of the Blessed beside the streams of Ocean. A former age, says Hesiod, calls them demi-gods (*ἡμίθεοι*). It is not clear what particular period of time is here meant. It has been customary to understand by the former age the age of the heroes themselves, and to see in *ἡμίθεοι* an early belief in hero-cult similar to that well-defined worship of heroes which we find in protohistoric and historic times, at least down to Pausanias, and thence to deduce that heroes are «depotentiated» gods, who sank from mythology and myth to legend, and are related to the chthonic gods in nature and origin. (F. Deneken, J. Wassner, and others). Rohde combats this view, and thinks the cult-heroes are the glorified souls of the dead, differing even from the Demons, who are real deities of a lower order. The latter, as all the chthonic deities, were always immortal and never succumbed to death, though they were of the underworld. Heroes, on the other hand, he points out, were always conceived to have been once mortals and, what is important, to have gone through death, whence the hero's grave always became the centre of the cult. Ancestor worship, therefore, would seem to be the root whence alone the cult of heroes sprang, though when this was once in full development influence from the cult of the chthonian deities was, of course, to be expected. But confusion between the two cults and the two sets of deities can hardly be shown to have existed in the Greek mind. Hesiod's *ἡμίθεοι* Rohde interprets as merely defining their place between gods and men, and not in any sense indicating their origin. Certainly Homer knows nothing of the later hero-cult. The one striking passage in the 'Iliad' where the heroes are called demi-gods (*ἡμίθεοι*) is known to be an interpolation and probably much later than the older parts of the poem. In the 'Iliad' the heroes are the warriors who fight before Troy, generally kings and sons of kings, but not infrequently participants in the struggle who are of meaner origin. The 'Odyssey' extends the meaning of the term to include wise and venerable old men. To the Homeric heroes life is a serious matter and death a grim affair. True, they are men of great mold and do mighty deeds; but that is because their purpose is lofty. They live and work and battle, however, in the shadow of common human fate, and after death there is for them no «Islands of the Blessed.» The very heroes who in Hesiod are made to people these happy realms are in Homer consigned to a gloomy fate, and they prefer any condition of life to the happiest lot possible in the land beyond the tomb. Little of glorified deification is there, indeed, in the greeting of the shade of Achilles to Ulysses in the 'Odyssey' when the latter had the boldness of heart to visit Hades to obtain the counsel of Tiresias (XI, 488).

Hero-cult and Hero-worship.— The cult of heroes, except in the case of Hercules, of whom the Greeks themselves were not sure whether he was a god or a hero (Herod. 2, 44, Paus. 2, 10, 1), was always sharply differentiated from that of the higher gods, but had, indeed, much in common with the homage paid to the chthonian gods. The centre of the worship was the grave where the mortal remains of the hero were supposed to be interned. This was generally located in a sacred grove and surmounted by a temple. Altars were erected over the place of sepulture or nearby, where divine honors were paid to the hero, sacrifices made to him, and votive or propitiatory gifts presented. These ritualistic observances, however, generally took place in the evening to mark the distinction from the homage paid to the gods, for whom the morning hours were reserved. Like the designations of the gods, too, the names of heroes became ejaculatory expletives and words of asservation. A survival of ancestor worship, and incidentally an indication of the human origin of heroes, is seen in the offering of food and drink to them on their special feast days and on other stated occasions. Along with the mortal remains of the heroes, relics of them were cherished and diligently sought out, officially transferred from one place to another, or even stolen from one shrine to be venerated at another. Thus, for instance, was held in esteem the house of Cadmus at Thebes and that of Menelaus at Sparta, the sceptre of Agamemnon at Charoneia, the stone at Salamis on which Telamon sat, and elsewhere the lance of Achilles, the wings of Dædalus, and the skin of the Calydonian boar and a tusk of the Erymanthian boar whose depredations had summoned so many heroes to the hunt. Most heroes were worshipped at places with which they were definitely identified during life, or where at all events their tombs were; but we not infrequently find that a cult was instituted elsewhere for a specific purpose, as to obtain a hero's help in war (Paus. 3, 3, 5f) or to ward off an epidemic or other national evils (Paus. 9, 38, 3). The cult-heroes and their worship were objects of legislative enactments. Porphyry recalls the decree of Draco ordering "gods and indigenous heroes" to be worshipped "publicly conformably to the laws of the country" and "privately according to the ability of each individual." ('De abstinentia,' iv, 22). This is the first recorded law anent the worship of heroes, but its provisions suggest great antiquity for the cult. Later legislators also paid heed to the honors due the heroes. Solon enjoined the greatest respect to their tombs, and Cleisthenes set up statues of the eponymous Attic heroes in the Agora with a view of building up a spirit of pan-Athenianism. Cleisthenes' attempt is not a solitary example of this method of developing national consciousness and civic pride. The chief characters of the older Greek myth and fable, and even historical personages of note, especially statesmen and conquerors, were in the course of time appropriated by one or the other of the Greek cities or communities, or by clans and families, as the eponymous hero and appropriately worshipped. The cult of heroes became so active indeed throughout the whole Greek world that it led, perhaps supported by the equally widespread ancestor worship, to a process of raising distinguished rulers, statesmen, poets, philosophers, and even citizens of lower rank, to the dignity of heroes with all the observances of worship. The dramatists, Æschylus and Sophocles, and the physician, Hippocrates, along with such public personages as the tyrants Gelon of Syracuse and Theron of Agrigentum, and Timesius, founder of Abdera, enjoyed such heroization. Alexander the Great, after his return from the Orient, among other ideas thence imported, made heroic apotheosis an official act, and himself decreed the raising of Hephæstion to the status of a hero, whose worship spread rapidly. In some countries the custom became so general that every person, even to slaves, was described as a hero in his epitaph, and at Theos incense was offered to a flute-player during his lifetime.

Teutonic Heroes.— Teutonic heroes are best known to-day through the operas of Wagner and popular renderings of the Norse Edda stories. The gods of northern mythology, Odin (Woden, Wotan), Thor (Thunor, the thunder-god with his hammer), Frey, and the mischievous Loki, together with the genuine legendary hero Siegfried, who like Achilles of old was invulnerable except in one spot, and the Valkyrie Brunhild, or Brynhild, are household words at least in America. The mythical elements of the last two suggest, at first hand, a connection with the Norse gods in origin and nature, which scholarship once maintained and popular feeling still holds to. It has been unmistakably shown, however, that, except for chance influences one way or the other, the Norse gods and the heroes of Teutonic legendary history had independent origin and went independent ways of development. (Cf. especially Mogk in 'Forschungen zur deut. Phil., Festgabe für Rudolf Hildebrand' 1894, p. 1, and Golther in *Germania*, xxxiii, 469, 476). S. Bugge even has pointed out that a number of the Northern gods were really developed during the Viking age out of Christian legends, later, therefore, than the poetic invention of the heroes. Teutonic heroes are usually connected with the migration of nations in the 4th and 5th centuries and the origin of heroic saga is assumed to be indicated by Tacitus who tells us that the deeds of Arminius were sung as late as a hundred years after his death. ('Annals' ii, 88). The historical period of the sagas, it is true, is separated from Tacitus' narrative by quite 400 years, but it is not inept to suppose that other notable characters in the history of the Teutonic nations were in like manner immortalized. The great national awakening that must have come to some of the northern races in their conquest and possession of the fair and opulent Roman provinces brought with it leaders and warriors whose renown could not but eclipse that of their predecessors and draw to themselves the limelight of epic popularity. Among the great historical characters of the period who are thus held to have become the theme of minstrel song and epic saga are Ermanric, the East Goth, who ruled in southern Russia at the end of the 4th century; Theodoric the Great, who founded the East Gothic kingdom in Italy; and Attila, the Hun, who, though not himself a Teuton, was so prominently identified with the migration that poetic fancy appropriated him and made him a powerful and generous Teuton king, surrounded by his loyal retainership. Many other heroes of saga are thought to have historical prototypes in Teutonic kings, of the age of migration. Among these the more prominent are: Hagen, the Frank; King Gunther, the Burgundian; Walter of Aquitaine and the Burgundian Princess Hildigund. The 'Beowulf,' the Old English epic, the earliest in composition of all Teutonic poetry, introduces in epidosic narratives a host of heroes who are better known to modern readers through the longer stories of the Edda and the 'Nibelungenlied.' A figure who runs through many of the Teutonic legendary histories, and perhaps is the only one who survived to later literature is Wieland — Walter Scott's Wayland the Smith.

Celtic Heroes.— The Celts possessed many myths regarding heroic figures, who were either ideal creations, or in the rich fantasy thrown around them tended to become mythical. The three best known are Cuchulainn, Finn (Fionn mac Cumhail) and Arthur. Cuchulainn and Finn belong to Irish legendary history; Arthur, the central character of mediæval romance, is in legendary history at home in Britain, or more narrowly in Wales, though we first meet him in French works. Cuchulainn is the hero of Ulster and was one of the courtiers around King Conchobar. His wanderings and exploits recall the deeds of Hercules. Finn belongs to Leinster and fights the rest of the Irish, including the men of Ulster. J. A. Macculloch suggests that the hero's identification with Leinster may be due to Leinster annalists of the 11th century rewriting history in the light of later developments and with an eye single to the glory of their own part of the country. Finn has survived to modern literature in the fame of his son Ossian (Oisin), the warrior-bard of Macpherson's poem of that name. Saint Patrick in the legend converts Ossian's son, Oscar, and meets the old Caoilte, the last of the Feinn, or Finn's men, who had survived the last dreadful battle of Gabhra. But the glory of Celtic heroic saga is Arthur, son of Uther Pendragon, king of Britain. Unlike the Teutonic heroes, Arthur and the Knights of the Table Round have but fabulous historical antecedents. Even this they lose, and in later literature become more and more creations of myth and fancy until with Tennyson they become like Excalibur "mystic, wonderful," emblems and types of moral virtues and vices. A Welsh legendary character of the ‘Mabinogion,’ Peredur, the "Seeker of the Basin," later mediæval romance made into Parzival, the Knight of the Grail, and thus joined to the Arthurian cycle the stories of the mystical Cup of the Last Supper.

Romance Heroes.— The countries of western Europe that once formed the Roman Empire gave birth to a class of heroes and a body of legend that had its inception in the wars waged by Christian princes against the growing and ever-threatening menace of Saracen domination. The first clashes between Christian and Moslem came in the 8th century when the stretching south of the Frankish monarchy towards the Pyrenees brought it in contest with the conquering Moorish emirs of Spain. By a confusion of ideas resulting from the ignorance of Westerns regarding things Oriental, the Saracens and Moors were thought to be idolators or pagans, whence in literature the Mohammedans came to be known as Paynims. By a similar misconception Mohammed was contracted into Mahmet (Mahmout) and meant "idol," and Mahmetry (Mahmoutry) came to signify "idolatry." In legend, therefore, the Romance heroes, down to their last descendants in poetry are the champions of Christianity against paganism. The chief historical character of the earlier wars against the Moors of Spain was the Frankish king, Charles Martel, who from the decisive battles of Tours (A.D. 732) to the capture of Narbonne (A.D. 759), dealt the Saracens, who had established a kingdom in France, a series of telling death-blows and drove them forever beyond the Pyrenees. His exploits were in legend transferred to his more famous son, Charlemagne, whose wars were chiefly against the pagan and barbarous people, called Saxons, in the countries north of France. His warfare against the Saracens was not so glorious, and his army on the retreat from Spain was attacked at Roncesvalles in the Pyrenees, where the noblest of the Frankish chieftains, among them Roland, or Orlando, governor of the marches or frontier of Brittany, were killed. Roland's name became famous in after times and the disaster of Roncesvalles became eventually the most celebrated episode in the whole cycle of romance. It is probably through Roland, therefore, that Charlemagne drew to himself, in the opinion of the early historians and the writers of romance, the more famous exploits of his father and became with his knights once for all the chief heroes of the "chansons de geste." The earliest of these "chansons de geste" is the ‘Chanson de Roland.’ Like Arthur, Charlemagne's person and character became obliterated in the romances and the chief stories circle around his knights, who are called Peers, as being on a footing of equality among themselves, or Palladins (Lat. *palatinus,* from *palatium,* palace), implying that they were inmates of the palace and intimate associates of the king. The number of the Peers or Palladins is usually 12. Beside Roland they are his friend Oliver; Ogier the Dane; Huon of Bordeaux; Renaud of Montauban; the traitor, Doon of Mayence; Ganelon, treacherously responsible for Roland's death; Archbishop Turpin, as good a specimen of a muscular churchman as Robin Hood's Friar Tuck; William Fierabras; William of Toulouse; William of Orange (the three last probably identical personages); and Vivien, nephew of William of Orange. The later wars against the Saracens in Spain developed for the Spanish people the Cid and Bernardo del Carpio, the latter the Spanish Roland. Curiously too Alexander the Great became a favorite character in the mediæval romances.

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HEROES AND HERO-WORSHIP. In 1837 Carlyle had produced ‘The French Revolution’ (q.v.), which established his fame, but brought him little money. Good friends rallied to his aid, and helped to set him on his feet by organizing courses of public lectures for him, drumming up an audience and selling guinea tickets. Between 1837 and 1840, Carlyle delivered four such courses; the proceeds tided him over his money difficulties, and put him definitely beyond the reach of want. The final course on «Heroes» was the greatest success of all, Carlyle's «crowning mercy,» as a lecturer. From the notes he had prepared for this course, he wrote out the book, ‘Heroes and Hero-Worship,’ reproducing the curious effects of the spoken discourses. The book was as successful as the lectures.

To describe ‘Heroes’ as an introduction to universal history might seem to overweight it; but the survey covers roughly the whole activity of man upon the planet. Carlyle was an historian dowered with a unique style, a penetrating and constructive imagination, and a sense of the picturesque vouchsafed to few. No previous book presented such a series of arresting, original generalizations on history, or such just appreciations of so many diverse careers and personalities. Mahomet, Dante, Shakespeare, Luther, Knox, Johnson, Rousseau, Burns, Cromwell and Napoleon are characterized in unforgettable terms as well as the movements they represented, or conducted. Carlyle's power of appreciation was catholic. For the first time in English, he showed that Mahomet was something more than a sensualist and an impostor. For the first time, he pictured the real Oliver Cromwell. Following up this first pronouncement, with his monumental history of the great Puritan leader, he absolutely reversed English opinion and made possible the statue of the regicide in the Palace Yard at Westminster. Lord Acton says Carlyle invented Oliver Cromwell. On all these representative men, Carlyle had true and weighty things to say which had never been said before.

The book made its influence felt at once on current thinking. In 1849, an acute foreign observer wrote: «The rehabilitation of the hero is to-day of all Carlyle's ideas the most widely spread, and the one which has made head most rapidly. . . . This idea is the basis of Emerson's philosophy, and has inspired all his essays on confidence in oneself, and the power of the individual.» Ruskin's determination to *do* something and *be* something has been attributed to his reading of ‘Heroes.’ It had also a great influence upon the life and character of Phillips Brooks. To aspiring youth with high hopes and lofty ideals it has a special appeal.

ARCHIBALD MACMECHAN.

HEROIC ACT, in the Roman Catholic church, the offering to God by a member of the church militant for the souls in purgatory all the meritorious works which he will perform during his lifetime, and all the suffrages which may accrue to his benefit after his death. Its practice is based on the Catholic doctrine of the communion of saints by which the good deeds of one member benefit all other members. The heroicity of the act arises from the willingness of the maker to take upon himself all the dreadful pains of purgatory for the love of his neighbor, its merit arises from the intense charity and altruism which inspires it. The heroic act is not a vow, but is of the nature of an offering to God, and, unlike a vow, is revocable at will, although a vow «never to revoke the Act» is probably binding.

HEROIN, hĕr'ō-in, $C_{17}H_{17}NO_3.(CH_3CO)_2$, the diacetic ester of morphine. It occurs as a faintly bitter, colorless, odorless, crystalline powder, which is nearly insoluble in water. It is soluble in dilute acids, however, and is precipitated by alkalis. Its hydrochloric dissolves freely in water and in alcohol, but is insoluble in ether. It is a relatively feeble analgesic, and a dangerous habit-forming drug. It is sometimes useful in the treatment of dyspnœa. The dose should be small, as a single dose of two and a half grains has caused alarming symptoms. Heroin was first prominently introduced to the medical world in 1898.

HEROLD, ā-rōld, **Louis Joseph Ferdinand,** French musical composer: b. Paris, 28 Jan. 1791; d. Thernes, near Paris, 19 Jan. 1833. A pupil of the Conservatoire, he also studied composition under Catel, Méhul and Cherubini, and in 1812 won the Prix de Rome with the cantata ‘Mlle. de la Vallière.’ His first opera, ‘La Gioventú di Enrico Quinto’ (1815) was received by the Neapolitan public with applause. His first serious début as composer for the French stage was with his comic opera ‘Les Rosières’ (1817). This very successful work was followed in quick succession by numerous others of varying fortune. In 1828 he was elected a member of the Legion of Honor. At last in 1831 appeared his ‘Zampa,’ and in 1832 his ‘Le Pré aux Clercs,’ the operas on which his fame chiefly rests, and which have gained a permanent place, the former especially being still produced with acceptance in the principal cities of the Continent. Consult Jouvin, ‘Herold sa Vie et ses Œuvres’ (1868); and Pougin, A., ‘Herold’ (ib. 1906).

HERON, Matilda, American actress: b. Draperstown, near Londonderry, Ireland, 1 Dec. 1830; d. New York, 7 March 1877. She was brought to the United States as a child, and appeared on the stage for the first time in Philadelphia in 1851 as Bianca in ‘Fazio.’ Her chief parts, in which she met with great success throughout the United States, were Camille in ‘La Dame aux Camélias’; and Ulah in ‘De Soto.’ She played in all the principal cities of Canada and the United States and appeared in London in 1861. In 1857 she married Robert Stoepel, from whom she was divorced in 1869. After retiring from the stage she taught elocution in New York.

HERONDAS, or **HERODAS,** Greek poet, probably flourishing about the latter half of the 3d century B.C. Little positive information is obtainable concerning the place of his birth, but it was probably in the island of Cos. Prior to 1891 only a few fragments of his verses had been found, but in that year an Egyptian papyrus was found containing several poems (mimes or mimianibi) and these were published by F. G. Kenyon, thus bringing to light a phase of Greek life and times of which the history has been meagre. Seven of the poems are in comparatively complete form, and, besides giving an insight into Herondas' life and work, they picture the everyday life of the times in extremely realistic terms, though the satirical portions of them are not personal in their nature. In composition the mimes are in choliambic verse or iambic trimeter and are written in the Ionic dialect. Consult Crusius, 'Untersuchungen zu den Mimiamben des Herondas' (Leipzig 1892); Kenyon's 'Classical Texts from Papyri in the British Museum' (London 1891); Sharpley, 'A Realist of the Ægean' (London 1906). See MIME.

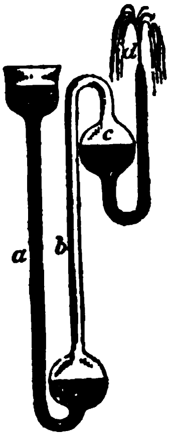
HERONS, wading birds of the order *Herodii,* forming, with egrets and bitterns, the family *Ardeidæ.* The family is characterized by a thin, compressed body; a long, thin neck; a straight, narrow, pointed beak; fully feathered head; longish, slender legs; three toes in front, the two outer united by a membrane, the middle claw pectinate; large, blunt wings; extensive development of powder-down tracts of disintegrating, shaftless feathers; and often by elongated feathers of the top of the head and other parts. Upward of 70 species of herons and their immediate allies are known, of which 14 inhabit North America. The bitterns (q.v.), with 10 tail-quills, form the sub-family *Botaurinæ,* the herons and egrets (q.v.), with 12 tail quills, the *Ardeinæ.* Egrets are simply small white herons. The great blue heron (*Ardea herodias*) to which *A. cinerea* of Europe is closely related, inhabits all parts of North America and northern South America. It is a large bird with a length of about four and a spread of nearly six feet, and of beautiful slate-blue color, with the long flowing plumes black. It is to be found by the side of streams, lakes and the seashore, usually alone. Fish form the bulk of its food, but it also devours frogs, small reptiles, insects and almost any kind of animal which it can capture. It roams in search of food mostly in the morning and evening. The heronry, or breeding-place, is usually found among high trees, and the same breeding-place is used by successive generations if they are unmolested; frequently several species of herons consort together at a favorite breeding-place. The large nest is made of twigs and sticks, and is lined with rushes, grass and various similar materials. The eggs, usually three or four in a nest, are of a fairly uniform greenish blue color. Many nests are usually found in one heronry, and sometimes the nests are built on the ground or on a cliff. The cry is a sort of "crank, crank," uttered in a hoarse voice. In the North the blue heron is migratory, elsewhere it is resident. The little blue heron (*A. cærulea*) is found in the eastern United States from the Middle States southward and in the West Indies and Central America. It is scarcely more than one-half the size of *A. herodias* and exists in two color phases, the one dark slate-blue with purplish reflections on the head and neck, the other white with traces of blue, especially constant on the unfeathered parts. This species formerly bred with other southern species in great heronries, most of which have been decimated by plume-hunters.

The little green heron or fly-up-the-creek (*Butorides virescens*) ranges throughout temperate North America and somewhat beyond southward, breeding nearly everywhere. Northward it is migratory and is the familiar heron about the streams and ponds of the Middle and New England States, where it usually nests in pairs or small communities and mostly in thick bushes or cedar trees; in other localities it sometimes breeds with larger species in heronries. The pale greenish elliptical eggs are from three to six in number. Its foods consist chiefly of small frogs, minnows and snakes, for which it searches by day as well as by night along the shallows of streams, where its harsh cry of alarm is often the first intimation of its presence. The name refers to the beautiful deep bronze green color of the upper parts.

The night-herons (*Nycticorax nævius,* and *N. violaceus*), which are closely related to the *N. grisea* of Europe, are easily distinguished from other herons by the thick, stout beak. The former, known as the black-crowned night-heron or squawk, is common throughout the United States and Canada in summer, and in the winter migrates far into South America, while the latter, or yellow-crowned species, is much less frequent and chiefly confined to the sea-coast of the warm parts of America. The squawk is about two feet long, the young brownish, the adults deep green and blue-gray above with two or three very long filamentous white occipital plumes. The night-herons are more active after dark than any other species, and are seldom seen abroad, except in the dusk or on cloudy days. Many species of herons reside in the warm parts of Africa and Asia, among them being the largest of all, the *A. goliath.* Consult Baird, Brewer and Ridgway, 'Water-birds of North America' (1884); Reichenow 'Journal of Ornithology' (1877); Job, 'Among the Waterfowl' (1902). See BITTERN; EGRET.

HEROÖPOLIS, an ancient Egyptian city found by excavation in the eastern Delta region. Maps made prior to 1880 generally located the city near the present city of Suez, but the excavations of Naville in 1883 under the auspices of the Egypt Exploration Fund tend to show that the city was farther north. Heroöpolis is given in the Septuagint version of the Old Testament as the meeting place of Joseph and Jacob. The Coptic translation is Pethom, very similar to the Hebrew Pithom, or "House of Tum," and for some time it has been known from Egyptian geographical lists that Pithom was situated in the land of Theku-t. This name has been identified with Succoth, the second resting place of the Children of Israel in their flight from Egypt. The Naville excavations brought to light the old site of Pithom and Succoth, the excavations being made at Tell el-Mashhutah, 12 miles west of Ismailah. A mile-stone which was recovered then showed the distance between Heroöpolis and Clysma to have been nine miles. This would confirm the view taken by Strabo that the city was at the head of the Red Sea navigation and was situated on what he called "Heroöpolitan Gulf," but if his view be correct, then it can only be inferred that the Red Sea extended at that ancient date farther north than it now does and that the place where the Israelites crossed was not where it is generally supposed to be, but considerably farther north.

HERO'S FOUNTAIN, a pneumatic apparatus, through which a jet of water is supported by condensed air. A simple mode of constructing it by means of glass tubes and a glass-blower's lamp is shown in the annexed figure. The column of water in the tube *a* compresses the air in *b;* this presses on the surface of the water in *c*, and causes it to gush out at *d*. This principle is made use of in several large installations, notably in northern Michigan, Canada and other mining sections, the water being drawn from a reservoir down a shaft *a*, a large chamber in the rock being excavated to hold the air, similar to the lower bulb. From the rising pipe *b* the air compressed by the water column is tapped for use. In this plan the bulb *c* is unified with the lower bulb and *d* becomes a mere overflow. Air is supplied constantly to the compression chamber by trapping it in the downward moving column *a*.



Hero's Fountain.

HEROSTRATUS. See Erostratus.

HERPES, an acute, non-contagious, inflammatory disease of the true skin, regarded generally as due to a lesion of nerve tissue. It is characterized by an eruption of one or more clusters of vesicles upon a reddened base. Several forms of the disease are recognized by dermatologists, of which the commonest are facial herpes and herpes zoster. Facial herpes constitutes the common fever blister, or cold sore, and is usually seen about the mouth, though it also occurs on other parts of the face. There is often some slight constitutional disturbance preceding the eruption, which first makes its advent known by a sensation of burning or itching in the part, followed by reddish discoloration of the skin and after a few hours by a number of pin-head to pea-sized blisters filled with clear or turbid fluid. After a few days these dry up and form a yellowish crust, which then falls off, leaving a red spot that soon disappears. The usual duration of the disease is about a week and it shows a strong tendency to recur. Herpes often accompanies febrile conditions such as pneumonia and malaria, and a similar lesion is not rare about the genitals. Herpes occurs mostly in those whose skin is irritable or delicate, and is usually the result of some derangement of the mucous membrane of the respiratory, digestive or genito-urinary tract. It sometimes is the unfailing harbinger of the menstrual period. Cold, mental depression, and injury or irritation of the skin are other causes. The disease belongs to the class of the neuroses, and in some instances its presence can be explained only on the basis of nerve disturbance. In most cases no treatment is required, as the lesions promptly heal of their own accord, but soothing ointments or lotions tend to relieve the irritation. The common domestic remedy is camphor ice. Herpes zoster, or shingles, is a special form remarkable for the fact that the eruption follows the course of certain nerves, and is usually disposed around one side of the body like a half belt. In rare cases it encircles the body. Its onset is preceded by stinging neuralgic pains, and by languor, lassitude, loss of appetite, shiverings, headache, nausea, quickened pulse, etc., after which the eruption appears in irregular patches. The vesicles become enlarged to the size of small peas in 24 to 36 hours, and fresh clusters occur for three or four days, completing the belt-like appearance. As the eruption recedes, by the fifth or sixth day, the vesicles become white and opaque, and the red margins grow livid or purple. Sometimes the vesicles burst, and several of the patches run together, forming irritable sores, discharging a thin serous fluid, which concretes and forms a crust that falls off as the parts beneath heal. The disease occasionally follows injuries to the nerves, and it is common in damp, cold weather of spring or autumn, when it sometimes occurs in epidemics. It is sometimes produced by sudden exposure to cold after violent exercise, and sometimes follows acute affections of the respiratory organs. The treatment consists in attention to any systemic derangement present and in the local use of soothing applications like talcum powder, protective dressings of cotton to prevent rupture of the vesicles, and the administrative of sedatives or even opiates in extreme cases. The duration of shingles is usually from 10 days to three weeks. Most cases run a favorable course and second attacks are rare.

HERPETOLOGY, hėr-pĕ-tŏl'ō-jĭ, the study of reptiles. In its earlier days, included under the term "reptile" were not only those now properly so named, but also the amphibia (q.v.) and some other "creeping things" not in either group. Cuvier's classification, the first approach to a scientific one, put both the true reptiles and the amphibians as corelated groups under *Reptilia;* but their distinction in form was soon perceived. Huxley showed that in their descent, embryology and structural relations, the amphibians were more closely related to the fishes than to the reptiles (lizards, serpents and turtles). He therefore united the two in a superior group *Ichthyopsida*, while he joined the birds to the reptiles in a group of similar rank called *Sauropsida*. But more recently the limits of herpetology have been restricted to truly scientific limits — the chordate class *Reptilia*, a definite group distinguished by the following characters:

Reptiles are cold-blooded, the temperature of the body not differing much from that of the natural surroundings, and rising or falling accordingly; the heart is three-chambered, except in crocodilians, where four chambers first occur in the upward scale of natural creation; mostly venous blood goes from the heart to the anterior viscera, and mixed blood to the posterior region, only the head and anterior regions receiving pure arterial blood; throughout their whole life they breathe with lungs, never with gills; the body is covered with scales, with which subjacent bony plates or scutes are sometimes associated; the vertebræ are absolutely gastro-centrous (biconcave); the skull articulates by a single condyle with the backbone, and the lower jaw works against the quadrate bone; the great majority are oviparous, while in some the eggs hatch within the mother.

This characterization unites into the one class one order represented by a single living species (the «Tuatera Lizard»), and the existing tortoises and turtles, lizards, snakes and crocodiles and many others now extinct. The group occupies a central position in the vertebrate series. Above it on the scale of organization are the birds and mammals; below it the amphibians and fishes. In respect to their phylogeny Gadow is authority for the statement, «On the other hand, there is not the slightest doubt that they are evolved from some branch of the Stegocephali (q.v.), whilst on the other hand the reptiles, probably through some branch of the Theromorpha, have given rise to the mammals; some other reptilian branch, at present unknown, blossomed out into birds.»

The uncertainty arising from the more or less fragmentary testimony of the fossil remains of reptiles of geologic times has necessarily a restraining effect upon the completion of a classification of the reptiles. Moreover, the distortion of skeletons in the processes of fossilizing renders close decisions as to genera and species very difficult. It is customary, therefore, with cautious scientists to halt the differentiation downward at the sub-order, recognizing that in the present state of knowledge of the Reptilia all classification must be tentative. The most recently attempted classification is that of Dr. Samuel Wendell Williston, presented in 1914, and this may be said to be the most that can be done with the data now available. Dr. Williston divides the class Reptilia into 12 orders and three provisional orders, as follows: Cotylosauria, with five sub-orders; Chelonia, with three sub-orders; Theromorpha, with three sub-orders; Therapsida, with three sub-orders; Sauropterygia, with two sub-orders; Proganosauria (provisional); Ichthyosauria; Protorosauria (provisional); Squamata, with three sub-orders; Thalattasauria (provisional); Rhyncocephalia, with three sub-orders; Parasuchia, with three sub-orders; Crocodilia, with two sub-orders; Dinosauria, with three sub-orders; Pterosauria, with two sub-orders. The anatomical differences upon which these divisions are established are detailed in Dr. Williston's ‘Water Reptiles of the Past and Present’ (Chicago 1914). (See REPTILES). Consult Boulenger, E. G., ‘Reptiles and Batrachians’ (London 1914); Cunningham, J. T., ‘Reptiles, Amphibia, Fishes, and the Lower Chordata’ (London 1912); Gadow, H., ‘Amphibia and Reptiles’ (London 1902); Zittel, K. A. von, ‘Text-book of Palæontology’ (Eastman's translation, London 1900–02).

HERRERA, ār-rā'rā, **Francesco de,** called EL VIEJO (the Elder), Spanish painter: b. Seville, 1576; d. Madrid, 1656. He broke with the Italian traditions of Spanish painting and became the founder of the Spanish national school. He also worked in bronze, and it was this probably which gave rise to the charge that he was connected with counterfeiters. He had a disposition so very detestable that his pupils, of whom Velasquez was one, all left him. The Louvre contains some of his works, among others ‘The Israelites Gathering the Quail in the Wilderness.’ But the best are at Seville, including the ‘Last Judgment,’ in the church of San Bernardo; ‘Saint Peter,’ in the cathedral; and ‘Moses Smiting Water from the Rock,’ one of four large canvases in the archiepiscopal palace. His frescoes at both Madrid and Seville have quite disappeared.

HERRERA, Francesco de, called EL MOZO (the Younger), Spanish painter: b. Seville, 1622; d. Madrid, 1685. He studied art under his father, Francesco, called El Viejo (q.v.) (to whom he was very far inferior as a painter), and remained some years at Rome. He was a founder of the Seville Academy (1660), and became its vice-director. Subsequently he was appointed court-painter to Philip IV. In the Seville Museum is his ‘Four Doctors of the Church Adoring the Host’; in the Prado Museum, ‘Saint Hermenegild.’ During his residence in Italy he painted fish with such success that he was known there as ‘Lo Spagnuolo dei Pesci.’

HERRERA, José Joaquin de, hō-sā' hō-ā-kēn, Mexican military officer: b. Jalapa, 1792; d. Tacubaya, 10 Feb. 1854. He joined the Mexican army in 1809, and in 1821 was promoted brigadier-general. He aided in overthrowing Iturbide, when the latter became emperor, and was successively Minister of War and president of the Supreme Court. President for a brief period in 1845, he again held office in 1848–51. During the war with the United States, he was aide to General Santa Anna.

HERRERO Y RUBIRA, Antonio María, Spanish writer: b. Borja (Zaragoza), 1714; d. Madrid, 1 July 1767. He was a brother of Luis Herrero y Rubira (q.v.). Graduated as a doctor of theology from the University of Tolosa, he went to Madrid to study medicine. There he began writing on various subjects. Receiving his medical degree, he was appointed by Fernando VI doctor to the general hospitals of the court. Here he continued writing on medical and other subjects. In his special field he acquired a high reputation which led to his being appointed a censor of medical books printed in Spain, and perpetual secretary of the Royal Medico-Matriteuse Academy. Among his published works are ‘Física Moderna’ (Madrid 1738); ‘Mercurio literario’ (Madrid 1738); ‘Disertación Meteorologica’ (Madrid 1737); ‘Impugnación’ (Madrid 1738); ‘Gaceta Literarie de Madrid’ (1740?); ‘Diccionario frances y español’ (Madrid 1743); ‘Vida d Tomás Kan-ħ-Kan Sophi de Persia’ (Madrid); ‘Milenario Apocolyptico’; ‘La lengua española’; ‘Los lugares de la Sagrada Escritura.’

HERRERO Y RUBIRA, Luis, Spanish writer: b. Borja (Zaragoza), 24 Feb. 1716; d. Calanda (Teruel), 1 Feb. 1769. He was a younger brother of Antonio Maria Herrero y Rubira (q.v.), and like his brother he pursued his literary and ecclesiastical studies in the universities of Huesca and Tolosa (de Francia), graduating from the latter with the degree of doctor of theology and of canonical law in 1734. He became an authority on the latter and attained a reputation as a writer, among his works being ‘La Vida de los siete sabios de Grecia’ (Madrid 1738); ‘Discurso historico fidosofico sobre los terremotos’ (Zaragoza 1756); ‘Arte de Pintura’; ‘Secreta naturæ’; ‘Reyes crueles y aborrecidos’; ‘Oplica mecanica’; ‘Arte de trabajar los vidrios que sirven para los anteojos de larga yista’; ‘No siempre quien escucha su neal oye’ (comedy); ‘Dos loas a San Juan Bautista.’

HERRERO Y RUBIRA, Sor Luisa del Espiritu Santo, noted Spanish religious writer, sister of Antonio Maria and Luis Herrero y Rubira (qq.v.): b. Calanda, 1711; d. 24 Aug. 1777. She lived in a religious atmosphere, both her brothers being priests, and her nearest relatives being strongly inclined in the same direction. In the Convent of Concepción de San Roque de Valdealgorfa were several of her aunts, and she became a nun in this convent while still almost a child. There she acquired great influence and was twice head of the institution. She was possessed of considerable poetical talent, which, had she had a broader field and more experience of life, might have made her one of the noted poets of Spain. A great student, she acquired a reputation as an authority on ecclesiastical history and sacred writings. Among her works are ‘Esposa y esposa’; ‘Novenario de Nuestra Señora de Monte Santo’ (Valencia 1773); ‘Sacro Novenario de Nuestra Señora del Pilar de Zaragoza’; ‘Glosa de la Salve’; ‘Oraciones a Maria Santisima’; ‘Auto Sacramental’ (1760); ‘Otro Dance al Santisimo y San Miguel’; ‘Su's Letrillas para la misa y festividad del Santisimo’; ‘Septenario espiritual.’

HERREROS, Manuel Bretón de, Spanish poet and dramatist: b. Quel (Logroño), 19 Dec. 1796; d. Madrid, 8 Nov. 1873. He left school to enter the army as a volunteer in 1814, in which he served until 1822. On his retirement from the army he held various offices under the government. In the meantime he gave considerable attention to literature, and in 1824 his comedy, ‘A la vejez viruelas,’ met with flattering success. Like other dramatic authors of his age, this initial success brought him employment in the way of translations and adaptations of dramatic works from French, some in prose and others in verse. This work included the masterpieces of several noted authors and covered 62 translations and 10 adaptations. ‘Los dos sobrinos,’ an original comedy, appeared in 1825, and ‘A Madrid me vuelvo’ in 1828. In all he wrote over 100 original comedies and dramas around which there was perhaps more bitter discussion than around the work of any other Spanish dramatist. So bitter and persistent in their attacks had his enemies become that he was forced to present his dramas under an assumed name. In 1831 he published a volume of poems which had already appeared in the newspapers; and in 1837 he was elected a member of the Royal Spanish Academy of which he soon became perpetual secretary. He was for some time editor of the *Gaceta* (1843–47). He resigned to become head of the Bibliotica Nacional, a position he retained until his death. Bretón de Herreros was one of the really great dramatists of Spain. He gave life and individuality to the Spanish drama of customs and characters, nearly all of which he drew from the ranks of the middle class, which he knew intimately and which he depicted vividly and true to life. Many of the French dramas which he adapted he revivified with his imagination and his dramatic genius, thus making them better than the originals. Among his published works are ‘Achoques a los vicios’ (1830); ‘El Ensayo’ (1831); ‘El Templo de la Gloria’ (1833); ‘Un novio para la niña’ (1834); ‘Elena’ (1834); ‘El Hombre gordo’ (1835); ‘La redocción de un periodico’ (1836); ‘Las improvisaciones’ (1837); ‘El hombre pacifico’ (1838); ‘Vellido Dolfos’ (1839); ‘El Pelo de la dehesa’ (1840); ‘Don Frutos en Belchite’ (1840); ‘Cuentas atrasadas’ (1841); ‘La escuela de las casadas’ (1842); ‘Estaba de Dios’ (1843); ‘A lo hecho pecho’ (1844); ‘Mi dinero y yo’ (1845); ‘Errar la vocación’ (1846); ‘Juan Garcia’ (1848); ‘Quien es ella?’ (1849); ‘Una ensalada de pollos’ (1850); ‘Los Poderes’ (1851); ‘La escuela del matrimonio’ (1852); ‘La cabra tira al monte’ (1853); ‘Cosas de Don Juan’ (1854); ‘Al pie de la litra’ (1855); ‘La hipocrecía del vicio’ (1859); ‘Entre dos Amigos’ (1860); ‘La hermana de leche’ (1862); ‘Maria y Leonor’ (1863); ‘Cuando de cincuen ta pases’ (1864); ‘El abogado de pobres’ (1866); ‘Los sentidos corporales’ (1867). Among the many editions of his works are one by himself, ‘Obras Escoyidas’ (1850–52), and that of Bretón y Orozco (1883). Consult Marqués de Molins, ‘Bretón de Herreros’ (Madrid 1883); Le Gentil, ‘Le poèt Manuel Bretón de los Herreros et la société espagnol de 1830 à 1860’ (Paris 1909); Piñeyro, ‘El Romanticismo en España’ (Madrid 1904).

HERRESHOFF, hĕr′rĕs-hŏf, **John Brown,** American shipbuilder: b. Bristol, R. I., 24 April 1841; d. there, 20 July 1915. During early age he was attacked by infantile glaucoma, which during his youth destroyed his sight, after which he remained totally blind for life. His education was carried on at the schools of his native town, but his real education was gained by contact with the problems of a practical life and surroundings, aided, where his limitations required help, by the constant attentions of a large and devoted family circle. In boyhood Mr. Herreshoff fitted up at his home a well-equipped machine shop and carpenter shop; in the former he laid the foundations of the mechanical skill and knowledge that he turned to such good use later in life, and in his wood-working shop he began building with his own hands small craft which served as a splendid study for the later work which made him so famous. Aided by his father, Mr. Herreshoff began the construction of larger craft at about the age of 20, and in the year 1863 he began naval construction as a business, which he carried on for more than 50 years with success. At first he had as partner, Mr. D. S. Stone, which firm lasted a few years only, then for a short period he was alone in the business, but in 1872 he drew to his side his brother and life coadjutor, Mr. Nathaniel

G. Herreshoff, seven years his junior, and well equipped in construction, engineering and designing. The introduction of steam power as applied to yachts, launches, torpedo boats and craft for trade opened a new and wide field, which they grasped with eagerness and which soon placed them in the mastery of the new field. The early use of the water-tube boiler gave the business a boom, and the performance of the first torpedo boat, *The Lightning*, built for the United States government, was a revelation in the then infancy of high speed craft. In 1879 Mr. Herreshoff and his brother, Mr. Nathaniel G. Herreshoff, incorporated the Herreshoff Manufacturing Company. The introduction of the compound engine in 1880 gave a fresh impetus to the business which was reflected by the construction of numerous steam yachts and torpedo boats and other naval craft for our own and foreign nations. In 1892 the Herreshoff Manufacturing Company took up the practical side of the defense of the Queen's Cup, which had been held at that date for 40 years by the New York Yacht Club, which successfully had held to the old trophy through many attacks from its motherland. The splendid series of defenses lasted about 13 years, in which the names of the *Vigilant, Defender, Columbia* and *Reliance* are fresh in the memory of all Americans, which, as well as the yet undetermined defense of the *Resolute,* goes to show to what height of perfection the Herreshoff Manufacturing Company have carried the science of naval designing and construction.

HERRESHOFF, Nathanael Greene, American naval architect and marine engineer: b. Bristol, R. I., 1848. He was educated in the public schools of Bristol and at the Massachusetts Institute of Technology. He was for nine years with Corliss Steam Engine Company in designing department, and since then with Herreshoff Manufacturing Company, holding office of designer and superintendent, and in 1915 took the office of president after the death of his brother, John B. Herreshoff. He has designed and superintended the construction of many successful steam yachts and torpedo boats, and also many fast sailing yachts, including seven for international racing in defense of the “American Cup.”

HERRICK, Christine Terhune, American writer: b. Newark, N. J. She is the daughter of Mary Virginia Terhune (“Marion Harland”). She was educated in private schools and by teachers in Rome and Geneva. She married James Frederick Herrick in 1884, who died in 1893. She is well known as a writer on domestic topics, and is a frequent contributor to the *Ladies' Home Journal, Woman's Home Companion, The Housekeeper, Harper's Bazar* and other magazines. She has published ‘Liberal Living Upon Narrow Means’ (1890); ‘Chafing-dish Supper’ (1895); ‘Cradle and Nursery’ (1889); ‘First Aid to Young Housekeeper’ (1900); ‘Housekeeping Made Easy’ (1888); ‘Little Dinner’ (1893); ‘What to Eat’ (1891); with Marion Harland, ‘The National Cook-Book’ (1897); ‘Cottage Kitchen’ (1895); ‘In City Tents’ (1902); ‘The Expert Maid Servant’ (1904); ‘Consolidated Library of Modern Cooking and Household Recipes’ (1905); ‘Sunday Night Suppers’ (1907); ‘Like Mother Used to Make’ (1912); with Marion Harland, ‘The Helping Hand Cook-Book’ (1912); ‘My Boy and I’ (1913); ‘The A B C of Housekeeping’ (1915).

HERRICK, Francis Hobart, American biologist and educator: b. Woodstock, Vt., 19 Nov. 1858. He was educated at Dartmouth, Johns Hopkins and the University of Pennsylvania, and was instructor in biology in Adelbert College (1888–91), and since the latter date professor of biology in the same institution. Among his published works are ‘The American Lobster’ (1895); ‘Home Life of Wild Birds’ (1902–05); ‘Natural History of the American Lobster’ (1911); ‘Audubon the Naturalist’ (1917).

HERRICK, Myron T., capitalist and diplomat: b. Huntington, Lorain County, Ohio, 9 Oct. 1854. His ancestors, of the same line as that of Robert Herrick, the English poet, came to this country from Loughborough, Leicestershire, England, early in the 17th century. His grandfather, Timothy Herrick, one of the pioneers of Lorain County, was a soldier in the War of 1812. At the battle of Sacketts Harbor he was taken prisoner and sent to Canada. When released, he walked to Ohio, and upon locating his land warrant received for services in the war, built a log cabin in the woods and prepared as best he could to receive his family. He then returned to Watertown, N. Y., and brought his family of six children on to Ohio in ox teams. On his mother's side, Mr. Herrick is descended from Jeduthem Cross, who came from England to America and settled in Massachusetts in the early 17th century. Mr. Herrick's father was Timothy R. Herrick, of Wellington, Lorain County, Ohio, a farmer of importance and influence. Myron T. Herrick was educated in a district school, in the high school at Wellington, and later studied at Oberlin College and Ohio Wesleyan University, which latter institution conferred upon him the degree of A.M. Mr. Herrick studied law at Cleveland, Ohio, and was admitted to the bar in 1878. On 30 June 1880 he married Caroline M. Parmely, of Dayton, Ohio. He practised law, in which he was successful, but retired in 1886, becoming actively engaged in banking and manufacturing. In 1894 Mr. Herrick was elected president of the Society for Savings in the City of Cleveland, having been its secretary and treasurer since 1886.

Mr. Herrick filled many positions in the councils of the Republican party, and from 1888 devoted a large part of his time to public service. He served as aide-de-camp on the staff of William McKinley when governor of Ohio. Later when Governor McKinley became President, he tendered to Mr. Herrick the position of Secretary of the Treasury in his first Cabinet, which was declined for business reasons. In President McKinley's second term he offered Mr. Herrick the ambassadorship to Italy, which offer was renewed by President Roosevelt, but was declined in both instances on account of his large business responsibilities. Mr. Herrick was president of the American Bankers Association in 1901. At the Republican

State Convention of 4 June 1903 he was unanimously nominated as Republican candidate for governor and was elected by the largest majority in the history of the State, 113,802 votes, over Tom L. Johnson, his opponent. Mr. Herrick served one term in that office. His record stands among the first as an efficient and successful executive. He was offered the United States Treasury portfolio by President Taft at the beginning of his term, which was declined for business reasons. Later he was offered the ambassadorship to Brazil, which was also declined. In 1912 he accepted the ambassadorship to France, which he had once before declined, and at the outbreak of the World War in 1914, as American Ambassador, took over the German and Austrian embassies. On 2 Sept. 1914, preceding the battle of the Marne, when the French government removed to Bordeaux, Mr. Herrick requested his government to permit him to remain in Paris, as, in his opinion, the American interests were such that they could be better represented in Paris. Upon the departure of the diplomatic corps from the British, Turkish and Japanese embassies and the legations of various other countries, Mr. Herrick took over the representation of these interests. Three years later when Lord Northcliffe visited America, he said in an address, «I had the honor of meeting Ambassador Herrick in almost the earliest stages of the war, when between one and two millions of Germans were marching on Paris, and when Paris, with almost twice the number of inhabitants of Cleveland, was panic stricken and the people were fleeing from that city. It was largely due to the man from Cleveland that that panic did not extend so far as to cause the whole population to leave and allow the Germans to march into Paris. That feat of Ambassador Herrick is one of the most remarkable achievements of any man during the war.»

Mr. Herrick formed the American Committee which occupied his residence as a headquarters. This committee rendered a great service in extending financial help to Americans and others who had been traveling in Europe at the outbreak of the war and who found themselves suddenly without funds and in need of advice and help. Mr. Herrick and his wife were largely instrumental in establishing an American ambulance hospital in the Elysée Pasteur at Neuilly, which was equipped and managed by resident Americans in Paris. It was established in 1914, having a capacity of about 1,600 beds, and performed a very great service. When America entered the war it was turned over to the Red Cross. The American Relief Clearing House was organized by Mr. Herrick and his home became its headquarters upon his leaving France. The Clearing House had also a branch in New York City and the admirable service which it has performed is well known to all Americans. Mrs. Herrick remained in Paris with her husband during the early days of the war, ministering to the needs of the stricken people of France, and as a result of her arduous duties in this connection, contracted the disease which resulted in her death on 15 Sept. 1918.

Before war was declared Mr. Herrick's successor had been appointed, and although he had then served nearly two years under a Democratic administration, he remained at his post at the request of President Wilson until long after the battle of the Marne, returning to America in December 1914. After retiring from office, the French government in recognition of his services, conferred upon him the cross of the Legion of Honor. He was also admitted to membership in the Gens de Lettres. The British government presented him with a piece of old English plate, and in his letter of transmittal the British Ambassador wrote: «His Majesty's Government desires to ask your acceptance of this piece of old English plate which they hope will serve to you and yours as a memorial of the exertions which you so devotedly and generously employed on behalf of the British subjects, both soldiers and civilians, in that time of stress and suffering and as a token of the King's grateful recognition of the same.»

Before the war Mr. Herrick had been interested in securing the participation of France in the Panama-Pacific Exposition in San Francisco in 1915. After the declaration of war most of the European countries decided to give up their preparations, but the French government voted to continue with its plans «in compliment to Ambassador Herrick,» as they said. Mr. Herrick initiated the rural credit movement in this country, and upon taking up his residence in France, the ambassadors, ministers and councillors of various European countries were directed by their governments to report to him rural conditions and credit systems existing in these countries. In 1913 he reported the results of his investigations to the Department of State, and later published a book on the subject, ‹Rural Credits› (New York 1914).

For many years Mr. Herrick was a director of several railroads representing foreign interests. He is interested in many business enterprises which have been uniformly successful. Among them are the National Carbon Company and the Union Carbide Company, which have merged under the name of the Union Carbide and Carbon Company and elected Mr. Herrick chairman of the board; and the Cleveland Hardware Company, in which he has been interested for over 30 years. He is a director in the New York Life Insurance Company, the National Surety Company and the Erie Railroad. Since returning to America, Mr. Herrick has received the honorary degree of LL.D. from Columbia, Harvard, Yale, Princeton and Western Reserve universities and from Miami, Union and Kenyon colleges. He has been presented with a medal by the National Institute of Social Sciences and is a trustee of Carnegie Institution of Washington. Immediately on his return to this country he became actively interested in war relief and is connected with many organizations engaged in this work, having given up the greater part of his time to these activities. Mr. Herrick has one son, Major Parmely W. Herrick, who is in the service of the United States army.

HERRICK, Robert, English poet: b. London, August 1591; d. Dean Prior, Devonshire, October 1674. His father, Nicholas Herrick, was a goldsmith; through inheritance and training the son was enabled to transfer to the making of verse the exquisiteness of his father's craft. Shortly after Robert's birth the elder Herrick made his will, and two days later he died, under circumstances that suggested suicide. To his wife and his seven children he left a small property.

After a few years, perhaps at Westminster School, and a brief apprenticeship to his guardian uncle, William Herrick, also a goldsmith, the poet entered Cambridge University, at first enrolling himself in Saint John's College. Two years later he removed to Trinity Hall, intending to study law. During his residence he seems, from letters to his guardian, to have frequently needed money, and he left the university in debt. He took his degree of B.A. in 1617 and of M.A. in 1620.

Few facts remain of his next years. He went to London and associated with the poets of the time, admirers of Ben Jonson, and he himself wrote verse. The words of two New Year anthems set to music by Henry Lawes were his; through the friendly influence of prominent men at court, he may have been known to the king and queen. By 1627, when he was chaplain of the Duke of Buckingham's expedition to the Isle of Rhé, he must have taken orders. Two years later, shortly after his mother's death, he became vicar of Dean Prior in Devonshire.

So little in Herrick's poetry suggests the priestly character that question has been made why he took orders at all; he himself spoke of his Devonshire years as pure exile from London and the world. Yet the traditions of his career at Dean Prior are entirely pleasant. His parishioners remembered him for his good humor and wit. He wrote his best poems in the little vicarage, whether in celebration of Prudence Baldwin, his housekeeper, or of Tracy, his spaniel, or of the village holiday ceremonies and superstitions, recorded with wonderful sympathy. Nothing more particular remains, save the legend of his keeping a pet pig in the house, and of his hurling a missile at an inattentive congregation — his only practical expression of ill-will toward Devonshire.

In 1647, evicted as a loyalist by Parliament, he returned to London, glad to be free of the quiet country, and set about publishing his poems. They appeared that same year, under the title of 'Hesperides, or The Works Both Humane and Divine of Robert Herrick, Esq.' The sacred poems bear the separate title, 'His Noble Numbers; or, His Pious Pieces, Wherein (amongst other things) he sings the Birth of his Saviour; and sighes for his Saviour's Suffering on the Crosse.' Nothing else is known of Herrick until 1662, when Charles II restored him to his old place at Dean Prior. The parish register records his burial on 15 Oct. 1674.

There is almost no contemporary reference to Herrick's poems, but the frequency with which they were reprinted in collections proves the favor they found. By the end of the century, however, they were forgotten, sharing in the Augustan neglect of Elizabethan and Stuart poetry. A mention of Herrick, with some of his poems, in the *Gentleman's Magazine,* 1796, and Dr. Nathan Drake's essays and quotations in his 'Literary Hours,' two years later, revived his fame.

Herrick's literary master, as he tells us in more than one fine tribute, was Ben Jonson (q.v.). Campion and the poets of the later songbooks foreshadow him, but it was through Jonson that he derived the tradition of Horace and the Latin epigrammatists, and he remained Latin in spirit, though his own carefully achieved simplicity is often near to Greek restraint. But it is not only in this literary inheritance that he belongs with Jonson; personally, if the Marshall portrait prefixed to 'Hesperides' is faithful, and if the assault upon the drowsy congregation is no fable, he illustrates with Jonson and other Elizabethans, and with Landor in later days, the paradox of violent and robust temperament reacting in fastidious art.

Herrick is first of all an artist; his merit is almost invariably a virtue of expression; he is master of the inevitable phrase. Many of his lyrics have indeed a larger perfection of form, yet he is most often concerned with the single word. His shortest poems, the numerous two-line fragments in which at first sight he would seem to scatter his genius, are frequently mere experiments in diction, usually for the sake of one word that he coins or discovers, easily recognizable for its curious awkwardness or its complete beauty. For among these trial pieces can be found some unhappy ventures, as well as astonishing verbal felicities.

This gift for language, part of the poetical equipment in general, is more marked in Herrick because of its intensity and its narrowness. It is so narrow as to be quite inflexible; far from exhibiting the Elizabethan faculty for adjusting the style to the most varied matter, Herrick subdues to one manner every subject he treats. The lines to his dying brother, the wedding songs for his friends, the epitaph on his housekeeper, and the recipes for country charms, are uttered alike in one voice and in one rigid though lovely tone. And in his choice of subjects he exercises none of the fine selection that distinguishes his diction; his conscious art is a thing of words only; in his themes he is at once almost the coarsest and the daintiest of English poets. This imperturbable manner, itself exquisite, becomes in the handling of shockingly different themes Herrick's chief limitation; here is felt a certain hardness of character, an ill-proportioned sympathy, or some deep defect of heart. But this impression is partly corrected elsewhere in his work.

The themes of Herrick's secular verse, upon which his fame rests, are given with characteristic confusion in the first poem of his book. He sings of youth and love — a Renaissance motive from which his cheerfulness or his limited sympathy subtracts most of the Renaissance sadness at the passing of beauty. He sings of his own numerous loves in the Horatian manner, leaving his admirers room to ponder whether he ever loved at all. He sings in his kindliest vein of fairy lore, and of country holidays; he identifies Renaissance springtime motives in the native village ceremonies around him, and gives to the English May festival something of the significance it had in Provence; and he is the first writer to chronicle at length that old English Christmas spirit which Irving and Dickens recovered. No poet who writes of such subjects with such delight can be altogether unsympathetic, and in the verses which are frankly about himself there is a frequent note of human pathos that partly disarms criticism of his less felicitous themes.

It is not surprising that his 'Noble Numbers' are little read; in them as in his secular verse he is the technical experimenter, the conscious artist, where conscious art is out of place. But in the 'Christmas Carols,' in the 'Graces for Children,' in the fine though fantastic 'His Saviour's Words Going to the Cross,' in the epigram 'Riches and Poverty,' and in the lines that Swinburne praised, 'Devotion Makes a Deity,' he shows feeling and thoughtfulness not unworthy of England's tradition of devout country parsons. See Hesperides.

Bibliography.— The best editions are those by Grosart, Saintsbury (in 'Aldine Poets') and Pollard, with an introduction by Swinburne, in the 'Muses' Library.' For criticism, consult 'Introductions' to the above; Grosse, E., in 'Seventeenth Century Studies' (London 1898); Aldrich, in 'Ponkapog Papers' (New York 1903); Moorman, F. W., 'Robert Herrick: A Biographical and Critical Study' (New York 1910); and the 'Cambridge History of English Literature' (New York 1907–16).

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HERRICK, Robert, American novelist: b. Cambridge, Mass., 26 April 1868. He was graduated at Harvard in 1890, and in 1895 became professor of English at the University of Chicago. His literary style displays much finish, while his studies of character are both keen and discriminating. He contributes regularly signed articles to the Chicago *Tribune*. He has published 'The Man Who Wins' (1895); 'Literary Love Letters and Other Stories' (1896); 'Love's Dilemmas' (1898); 'Composition and Rhetoric' (1899); 'The Web of Life' (1900); 'The Real World' (1901); 'Their Child' (1903); 'The Common Lot' (1904); 'The Memoirs of an American Citizen' (1905); 'Together' (1908); 'A Life for a Life' (1910); 'The Master of the Inn' (1908); 'The Healer' (1911); 'One Woman's Life' (1913); 'His Great Adventure' (1913); 'Clark's Field' (1914); 'The World Decision' (1916); 'The Conscript Mother' (1916).

HERRICK, Sophie McIlvaine Bledsoe, American microscopist: b. Gambier, Ohio, 26 March 1837. She was editor of the *Southern Review*, 1875–78, and was connected with the editorial staff of *Scribner's Magazine* and its successor, *The Century*, 1878–1907. She has published 'Wonders of Plant Life under the Microscope' (1883); 'The Earth in Past Ages'; 'Chapters in Plant Life'; 'A Century of Sonnets' (1902).

HERRING. The typical fishes of the family *Clupeidæ* (q.v.), to which also belong the shad, alewife, sardine (qq.v.) and other food-fishes, the numbers of which consumed make this the most important economically of all families of fishes. The true or sea-herrings belong to the genus *Clupea*. The common herring (*C. harengus*) of both sides of the north Atlantic swims in enormous schools containing countless numbers of individuals packed as closely as possible over areas of often 6 to 20 square miles. The herring is a migratory fish, but its movements are so complicated that much mystery still clings to them. The most satisfactory conclusions have been arrived at by a German commission appointed to study the natural history of the Baltic, etc., which concluded that the herrings live in the deep water off the coasts which they approach periodically chiefly for the purpose of spawning; that there exist a large number of distinct races, differing in size, form, times of spawning and various other peculiarities, and that each of these races swims in separate schools, which move independently and have different seasons and grounds for spawning. Spawning takes place at various seasons, according to locality, some schools spawning in the late winter, others in the spring and still others during the autumn months. The eggs are small and adhere in masses to seaweeds, stones, etc., on the bottom. Vast numbers are thus deposited in certain favored localities to which haddock and other fishes are attracted for the purpose of devouring them. The number of eggs produced by each fish is not especially large, being from 10,000 to 50,000, but nevertheless the natural productiveness of the herring has been sufficient to overcome inroads caused by the fisheries and the much greater destruction due to the hordes of bluefish, sharks, porpoises, gulls and other enemies which accompany the schools in order to prey upon them. Having only few and small teeth, the herrings cannot capture active living creatures, but, as they swim with quick, nervous movements, water is being continually taken into the mouth and strained through the gill-rakers. By this means great numbers of copepods and other minute forms of life, especially larval crustaceans, annelids and mollusks are retained within the mouth and swallowed.

The herring fishery is of stupendous importance to the countries of northern Europe. This is especially true of the Scandinavian countries, whose hardy fishermen take from the sea annually not less than 1,500,000,000 pounds. Scotland takes from 150,000,000 to 200,000,000 pounds and the other maritime nations usually smaller quantities. The herring is not found in the Mediterranean. On this side of the Atlantic the fishery is much less extensive, but is growing and is no doubt destined to reach a great magnitude, especially in the waters of British America, which furnish each year about 250,000,000 pounds. Although found as far south as North Carolina, the herring has a commercial importance only north of Cape Cod. The New England fisheries are chiefly confined to Maine. Most of the fish is sold fresh, either for food, or, early in the season, for cod bait; the remainder is salted or smoked. A favorite preparation is the partly smoked form of «bloaters.» Large quantities of young herrings are packed and sold as sardines. In the prosecution of the American fisheries use is made chiefly of several forms of drift or gill nets and seines; under favorable conditions of great tidal movements, as in the Bay of Fundy, great numbers are captured in weirs.

A closely similar species (*C. pallasii*) is found on the Pacific coast of America, and is the object of a rapidly extending fishery. Of the anadromous river-herrings or alewives

(*Pomolobus*), two species are of great commercial importance on the Atlantic coast of the United States, particularly southward, though the fisheries extend from Maine to Florida. They enter the rivers to spawn about the same time as the shad, with which they are caught chiefly in pound nets and seines. The greater number are smoked.

To the extensive literature of the herring the following references will serve as an introduction: Goode, ‹Fishery Industries of the United States› (1884); Smith, ‹Alewife Fisheries of the United States› (in Report of United States Fish Commission for 1898); Cunningham, ‹Marketable Marine Fishes›; ‹Report of the Commission for the Scientific Investigation of the German Seas› (a very important contribution in German); ‹Annual Reports› of the United States Commissioner of Fisheries; Samuel, A. M., ‹The Herring: Its Effect on the History of Britain› (London 1918).

HERRING GULL, the most numerous and widely spread of gulls, common in the breeding season throughout all the northerly parts of the world and migrating southward in winter. The silvery sheen of white and pearl-blue plumage are indicated in its technical name (*Larus argentatus*); and its habit of following schools of fishes and picking them up gives it the name of herring-gull. The same name is often given, however, to several others of the smaller gulls. See GULLS.

HERRNHUT, hĕrn'hoot, a small town or village in the kingdom of Saxony, in the circle and 18 miles southeast of Bautzen. It is situated at the foot of Hutberg Mountain, 1,054 feet above the level of the sea. It was founded by Count Zinzendorf 1722, for the use of the Moravian Brethren, and it afterward became the metropolis and centre of that sect of Christians, who, from this town, are often called Herrnhuters. (See UNITED BRETHREN). The town is built with great regularity and distinguished by the order, cleanliness and stillness which prevail in it. It has a great variety of manufactures, principally of linen, calico, tobacco and of articles in gold, tin, leather, etc. The objects of curiosity are the observatory and the burial-ground on a neighboring hill, resembling a garden, and called by the brethren «Garden of Peace.» Pop. 1,200.

HERRON, Francis Jay, American soldier: b. Pittsburgh, Pa., 17 Feb. 1837; d. New York, 8 Jan. 1902. He was graduated at the Western University of Pennsylvania in 1854, and on the breaking out of the Civil War commanded the Governor's Grays in the First Iowa regiment. In 1861 he was made lieutenant-colonel of the Ninth Iowa regiment. In 1862 he received the commission of brigadier-general of volunteers. Early in 1863 he joined General Grant at Vicksburg and commanded the left wing of the besieging forces as major-general (1862), until the capture of the city. He subsequently captured Yazoo City, with its boats and supplies; commanded the Thirteenth army corps and broke up the traffic along the Rio Grande; assisted President Juarez against Maximilian's forces, and in June 1865 received the surrender of the Confederate forces west of the Mississippi. In 1873 he took up his residence in New York, where he practised law until his death.

HERRON, George Davis, American clergyman and social reformer: b. Montezuma, Ind., 21 Jan. 1862. He was educated at Ripon College, Wisconsin, and also studied in Europe. He became pastor of the Congregational church in Lake City, Minn., and while there made an address («The Message of Jesus to Men of Wealth») before a Minneapolis club, which attracted much attention; he subsequently received a number of calls from important churches, and went as pastor to Burlington, Ia. Here he organized a club for the discussion of social questions, which was largely attended, especially by workingmen. In 1893 he accepted the chair of applied Christianity at Iowa College, resigning in 1900 on account of the objection to his teachings; he then organized a religious and socialist movement known as the «social crusade,» lectured on «The Economics of the Kingdom of Heaven,» and advocated a transformation of the present economic order to one more in harmony with the Christian idea of the brotherhood of man. In 1901 he divorced his wife, and married a second time. an action which aroused much criticism. He was deposed from the Iowa Congregational Council, and has since resided in Italy and is engaged in literary work. He has written ‹The Larger Christ› (1891); ‹The Call of the Cross› (1892); ‹A Plea for the Gospel› (1892); ‹The New Redemption› (1893); ‹The Christian Society› (1894); ‹The Christian State› (1895); ‹Social Meaning of Religious Experiences› (1897); ‹Between Cæsar and Jesus› (1899); ‹Why I am a Socialist› (1900); ‹From Revolution to Revolution›; ‹The Day of Judgment›; ‹Wagner and Parsifal› (1903); ‹War and Peace under Socialism›; ‹Socialism and Spiritual Expansion›; ‹Woodrow Wilson and the World's Peace.›

HERSCHEL, hĕr'shĕl, **Caroline Lucretia,** sister of Sir William Herschel (q.v.), Anglo-German astronomer: b. Hanover, Germany, 16 March 1750; d. there, 9 Jan. 1848. In her 22d year she went to England to reside with her brother, then organist in Bath. When William abandoned his former profession in favor of astronomy she became his helpmate, and when he was appointed private astronomer to George III she discharged efficiently all the duties of an assistant astronomer, for which she was allowed a small salary. Although these duties were very arduous, she yet found time to conduct a series of observations of her own with a small Newtonian telescope her brother had made for her. She devoted special energy to the discovery of comets, and was so successful as to be entitled to claim the priority of discovery of at least five. Several remarkable nebulæ and clusters of stars included in her brother's catalogue were described from her original observations. In 1798 her valuable work, ‹A Catalogue of Stars taken from Mr. Flamsteed's Observations, with Introductory Remarks by W. Herschel,› was published by the Royal Society. On her brother's death in 1822 she returned to her native country, where she died after an unusually protracted life, distinguished by useful scientific labors. The Royal Society recognized the value of her labors by bestowing upon her in 1828 their gold medal, and some time afterward by conferring upon her the privileges of honorary membership. Consult Herschel, M. C., 'Memoir and Correspondence of Caroline Herschel' (London 1876); and Clerke, 'The Herschels and Modern Astronomy' (ib. 1895).

HERSCHEL, Sir John Frederick William, English astronomer; only son of Sir William Herschel (q.v.): b. Slough, near Windsor, 7 March 1792; d Collingwood, Kent, 11 May 1871. He was educated at Eton and Cambridge. His first publication was 'A Collection of Examples of the Application of the Calculus to Finite Differences' (1820). but it was not until the death of his father that he devoted his special attention to those astronomical researches which have made the name of Herschel, so famous. He limited his first exertions to a re-examination of the nebulæ and clusters of stars discovered by his father, and in 1824, with James South, reported to the Royal Society the position and apparent distances of 380 double and triple stars, obtained by more than 10,000 measurements. This memoir attracted the notice of the French Academy, and they voted it their astronomical prize; and two years later the gold medal of the Royal Society was awarded to each of the astronomers. The results of the re-examination were given in 1833 to the Royal Society in the form of a catalogue of stars in order of their right ascension. The catalogue contained observations on 525 nebulæ and clusters of stars not noticed by his father, and on a great number of double stars, between 3,000 and 4,000 in all. His 'Treatise on the Theory of Light' appeared in 1827, that on 'Sound' in 1830, and in the same year was published his well-known 'Preliminary Discourse on the Study of Natural Philosophy,' one of the most charmingly written books on science. In 1831 he was created a knight of the Royal Hanoverian Order. In 1833 Herschel published in Lardner's 'Cabinet Cyclopædia' a 'Treatise on Astronomy,' subsequently enlarged into 'The Outlines of Astronomy,' of which several editions have been published. In the same year he undertook a private expedition to the Cape of Good Hope for the purpose of carrying out in the southern hemisphere observations similar to those he had made in the northern. Four years were spent near Cape Town (1834-37). His great object was to discover whether the distribution of the stars in the southern hemisphere corresponded with the results of his father's labors, prosecuted mainly on the opposite side of the Galactic Circle. That the observations might be strictly comparable they were made by the same method as Sir W. Herschel, and with a telescope of the same optical power. The whole number of stars counted in the telescope amounted to 68,948, included within 2,299 fields of view. By a computation based on the star-gauges in both hemispheres relative to the Milky Way, Sir John found that the stars visible in a reflecting telescope of 18 inches aperture amounted to 5,331,572; and more than this, the number really visible in the telescope was vastly greater, for in some parts of the Milky Way the stars were found to be so crowded in space as to defy all attempts to count them. The results of this vast labor were published in 1847. On Herschel's return to England in 1838 he was received with every public honor, and on the queen's coronation was created a baronet. He was buried in Westminster Abbey.

HERSCHEL, Sir William, Anglo-German astronomer: b. Hanover, Germany, 15 Nov. 1738; d. Slough, near Windsor, England, 25 Aug. 1822. He went to England in 1757, and at first was employed in the formation of a military band. Although enthusiastically fond of music, he devoted his leisure hours to mathematics and astronomy; and being dissatisfied with the only telescopes within his reach, he set about constructing one for himself, in which undertaking he succeeded, having in 1774 finished a reflecting instrument of five and one-half feet. Encouraged by his success he proceeded to complete larger telescopes, and from this period gradually withdrew from his musical engagements. Late in 1779 he began a regular survey of the heavens, star by star, with a seven-foot reflector and after 18 months' labor discovered, 13 March 1781, a new primary planet, named by him the *Georgium Sidus*, but now known as *Uranus*. George III gave him a pension, enabling him to devote the rest of his life to astronomy. At Slough, he commenced the erection of a telescope of the dimensions of 40 feet, and completed it in 1787. Its diameter was four and one-half feet, and it weighed 2,118 pounds. With this powerful instrument he continued to prosecute his discoveries, regularly communicating the results to the Royal Society till 1818. He was knighted by George III, and received honorary degrees from Oxford, Edinburgh and Glasgow universities. He was the first president of the Royal Astronomical Society. In 1783 he thought he had discovered a volcanic mountain in the moon and from further observations made with his large instrument in 1787 found he was the victim of an optical illusion. He discovered two of the satellites of Saturn, and the fact that his system of rings revolved and he measured his rotation and that of Venus, announced to the world that there were binary stars in the heavens, etc. Herschel received much assistance in making and recording observations from his sister Caroline (q.v.), and later his brother, a skilful optical instrument-maker, lent him valuable aid. In 1802 he laid before the Royal Society a catalogue of 5,000 new nebulæ, nebulous stars, planetary nebulæ and cluster of stars he had discovered. Consult Dreyer, 'Short Account of Sir William Herschel's Life and Works' (London 1912); 'Herschel, his Life and Works,' by Holden (1881); Sime, 'William Herschel and His Work' (New York 1900). His scientific papers were collected and edited in 1912 under the direction of the Royal Astronomical Society and the Royal Society.

HERSCHEL, Sir William James, British administrator: b. January 1833; d. 24 Oct. 1917. He was a grandson of the famous discoverer of Uranus, and son of the eminent arstronomer and chemist, Sir John Frederick Herschel, who is buried by the side of Isaac Newton in Westminster Abbey. William Herschel was graduated at Oxford and entered the Indian Civil Service in 1853. In 1859, while serving in the Hooghly district, he applied the first tests of the practicability of using finger-print impressions as a means of identification, with the object of circumventing the numerous cases of personation that came before the Bengal courts of justice. Owing to the general state of illiteracy, it was frequently impossible to apply the test of comparing signatures. In a report to the government Herschel recommended the adoption of the system throughout India, but his advice was not followed till many years later, when he had the satisfaction of seeing his methods applied in all parts of the world. He served as commissioner at Cooch Behar for some years and settled in Oxford on his retirement.

HERSCHELL, Farrer, Lord, English lawyer and statesman; b. Brampton, Hampshire, 2 Nov. 1837; d. Washington, D. C., 1 March 1899. He was educated at University College, London, and the University of Bonn. He became a barrister of Lincoln's Inn in 1860; was recorder of Carlisle 1873–80; solicitor-general 1880–85; and Lord High Chancellor in 1886, and again 1892–95. He was a member of the Venezuela and British Guiana boundary arbitration tribunal in 1897, and was subsequently appointed one of the high joint commissioners from Great Britain, on the Anglo-American Commission, designed to settle existing differences between the United States and Canada, of which he became president. During the sitting of the commission in Washington, D. C., in February 1899, he had a severe fall, from the effects of which he died shortly after.

HERTEL, hĕr'tĕl, **Albert,** German painter: b. Berlin, 19 April 1843; d. 1912. He studied at the Berlin Academy, where he became professor in 1875, and was made a member in 1901. Among his landscapes are 'Olive Harvest in Capri' (1872); 'Via Flaminia' (1872); 'After the Storm on the Coast of Genoa' (1878); 'Northern Coast Scene with Fishermen Returning' (1883); 'Road Between Rapalla and Santa Margherita' (1892); and 'View in the Roman Campagna' (1896). He also painted decorative subjects.

HERTEL DE ROUVILLE, ăr-tĕl dė roo-vēl, **Francis,** Canadian soldier: b. Three Rivers, Maurice County, Quebec, 1643; d. 1722. He was captured in 1681 and tortured by the Iroquois, who were so struck by his fortitude that they adopted him into their tribe. He succeeded in making his escape and as one of Frontenac's lieutenants performed, in 1690, some remarkable exploits against the English, from whom he captured Falmouth, now Portland, Me. Twenty-six years after this event Louis XIV tardily rewarded him with a patent of nobility.

HERTER, Albert, American artist: b. New York, 2 March 1871. He studied painting at Paris in the studio of Jean Paul Laurens. He has twice visited Japan and the years spent there have strongly influenced the character of his work. He is member of the Society of American Artists, of the Water Color Club and of the Water Color Society.

HERTFORD COLLEGE, Oxford, England, a foundation of Oxford University (q.v.), which in its modern form dates from 1874 when Thomas Charles Baring, then a member of Parliament for South Essex, provided an endowment for 15 fellows and 30 scholars, 7 lecturers and dean and bursar. The foundation now consists of a principal, 17 fellows and 40 scholars. In its earlier form the institution dated from 1283 when Elias of Hertford acquired a hall on the site which became known as Hert or Hart Hall. The hall was dependent on Exeter College until 1740 when a charter was granted establishing Hertford as a college. After a struggling existence the charter was declared void from 1805 and the Hertford scholarship endowed by the university in 1834 with part of its property was all that perpetuated the name until, in 1874, the principal and scholars of Magdalen Hall, an offshoot of Magdalen College from 1602, who had occupied the old buildings, reorganized anew and revived the title of Hertford College. The old buildings have undergone restoration and fine modern buildings have been added since 1903.

HERTLING, Georg F., Count von, German statesman: b. Darmstadt, 31 Aug. 1843; d. Ruhpolding, Bavaria, 3 Jan. 1919. After completing his studies in philosophy and history at Münster, Munich and Berlin he spent two years in Italy studying the dogmatic history of the Roman Catholic Church, of which he was an uncompromising adherent. In 1867 he settled as tutor of philosophy at the University of Bonn, obtained his professorship in 1880 and two years later was transferred to the chair of philosophy at Munich. For many years he acted as the unofficial representative of Germany at the Vatican, where he conducted numerous important German negotiations with the Pope, dividing his time between occasional university lectures at home and frequent visits to Rome. He sat in the Reichstag from 1875 to 1890 and again from 1896 to 1912, ultimately becoming the leader of the Roman Catholic Centre party. In 1912 he succeeded Count Podewils as Minister-President of Bavaria. Hertling had contributed to the overthrow of Von Bethmann-Hollweg, the Imperial Chancellor, both by the Bavarian opposition to «reform» and by his own influence with the Centre party. In July 1917, without consulting Von Bethmann-Hollweg, the Kaiser offered the chancellorship to Hertling, who refused the post, and it was given to an almost unknown Prussian official, Herr Michaelis (q.v.). The latter, handicapped by the critical position of Germany and his personal incompetence, held office for only three months and a half. On 1 Nov. 1917 Hertling was formally appointed Chancellor and Minister-President of Prussia. Though in his 75th year, he was at first very successful, handling the internal situation with adroitness, bargaining with the emperor and managing the Reichstag so skilfully that he was able to begin with something like a definite pledge from the Reichstag of acquiescent behavior for the duration of the war. He produced as much stability in Germany as would have sufficed if the troops could have carried out their promises and prevented the defection of Germany's allies and the military disaster in the West. If the German offensive in 1918 had succeeded, Hertling would have emerged from the ordeal as the «victorious Chancellor.» He carefully kept himself in the background as regarded foreign policy, leaving to Herr von Kühlmann the responsibility as well as most of the odium for the treaties of Brest-Litovsk and Bucharest. Before the end of June 1918 Kühlmann announced the impossibility of ending the war by purely military means and was dropped out of office. Hertling clung on through all the military disasters until the defection of Bulgaria, when he fell and was succeeded by Prince Max of Baden, the 8th and last German Chancellor. In his last speech to the Reichstag (September 1918), Hertling admitted that the situation was serious but not alarming; he declared that the German people would not beg for mercy and that the hour must come “when our enemies will see reason and make an end of the war.”

HERTZ, Heinrich, hĭn'riн hěrts, German physicist: b. Hamburg, 22 Feb. 1857; d. Bonn, 1 Jan. 1894. He studied at the University of Berlin, and in 1880 became assistant to Helmholtz there. In 1883 he was lecturer on theoretical physics at the University of Kiel; in 1885 was professor of physics at a technical school in Karlsruhe; and in 1889 succeeded Clausius as professor of physics at the University of Bonn. His most important work was his experiments with electricity, by which he proved that elec- ricity can be transmitted in electromagnetic vaves with the same rapidity as light, these vaves showing the same phenomena of refrac- ion, polarization, etc., as light waves. His first aper describing his electrical discoveries ap- eared in 1887, and others followed for many ears in *Wiedermann's Annalen*. He further eveloped and attested the truth of Faraday's lectromagnetic theory of light. It is by means f the Hertzian waves also that wireless teleg- aphy (q.v.) is made possible. His ‘Ueber die Beziehungen zwischen Licht und Electricität’ ppeared in 1890, and ‘Gesammelte Werke’ in 395. English translations have been published nder titles ‘Electric Waves,’ by D. E. Jones, ith a preface by Lord Kelvin (1893), and Miscellaneous Papers,’ by D. E. Jones and A. Schott (1896). Consult Bonfort, H., Sketch of Heinrich Hertz,’ published by the mithsonian Institution (Washington 1896).

HERTZ, Henrik, Danish dramatist and et: b. Copenhagen, 25 Aug. 1797; d. 25 Feb. 70. He was of Jewish parents but was con- rted to Christianity; was educated in the law the University of Copenhagen, but soon andoned this profession for the dramatic ld. In 1826–27 two plays by him were pro- ced, ‘Mr. Burchardt and his Family’ and ove and Policy.’ The comedy ‘Flyttedagen’ Moving Day’), followed in 1828 and in 1830 peared the comedy ‘Amor's Strokes of enius,’ in rhymed verse, a class of composi- n hitherto unknown in Danish literature. He blished anonymously in the same year engangerbrevene’ (‘Letters from a Ghost’) which he defended J. L. Heiberg. In 1832 ap- ared the didactic poem ‘Nature and Art’ and our Poetical Epistles.’ These were followed the comedy, ‘A Day on the Island of Als’ d, in 1835, by ‘The Only Fault.’ ‘The Sav- gs Bank’ (1836) was one of his most success- l comedies. Hertz, by this time, had been in- enced by the Romantic movement and his full nius was unveiled in the great national drama, vend Dyrings Hus,’ which was produced in 7. The year 1839 saw the less successful torical tragedy, ‘Valdemar Atterdag,’ but rld-wide fame came to the dramatist in 1845, the appearance of his lyrical drama, ‘Kong né's Datter’ (King René's Daughter), of ich translations have appeared in nearly all dern tongues. It was followed in 1848 by tragedy, ‘Ninon,’ by the comedy, ‘Tonietta’ 49); ‘A Sacrifice’ (1853); ‘The Youngest’ (1854); ‘Three Days in Padua’ (1869). Hertz's dramatic works have been collected and published (18 vols., Copenhagen 1854–73), and ‘Poems’ (4 vols., ib. 1851–62). See King René's Daughter.

HERTZKA, hirts'ka, **Theodor,** Austrian political economist: b. Pest, 1845. He was educated at Vienna and Pest; in 1872 became one of the editors of the *Neue Freie Presse*, Vienna, where he remained until 1879, when he founded the *Wiener Allgemeine Zeitung*. He was editor of the latter journal until 1886. In ‘Die Gesetze der Handels- und Sozialpolitik’ (1880) and ‘Das Wesen der Geldes’ (1887), he advocated the gold standard and free trade for Austria-Hungary. Later works were ‘Gesetze der sozialen Entwicklung’ (1886); ‘Freiland, ein soziales Zukunftsbild’ (1890; 10th ed., 1896); ‘Reise nach Freiland’ (1893). In these he described a socialistic community in Central Africa. He tried to found such an Utopia, and although many societies were formed to aid it, it failed about 1893.

HERULI, hĕr'ū-lī, a Teutonic tribe first heard of in history about the middle of the 3d century, who passed south from the coast of the Baltic and swept with the Goths into the eastern provinces of Rome and founded an empire on the Danube. They appear as reinforcements of Odoacer in his invasion of the western provinces of Rome in 476. Their king, Rudolph, formed an alliance with Theodoric the Great, but they were afterward conquered by the Longobardi. A part of them were driven toward Scandinavia, a part lingered on the borders of the Roman Empire. They did good service to the Byzantine Empire, but after encountering the Vandals in Africa, and the Ostrogoths in Italy, they vanished from history.

HERVIEU, ar'vye', **Paul Ernest,** French dramatist and novelist: b. Neuilly, Seine, 2 Nov. 1857; d. 1915. He was educated at the Lycée Condorcet and in 1877 was admitted to the bar. He spent sometime in the office of the president of the council; qualified for the diplomatic service and in 1881 was named secretary of the French legation at Mexico City. He resigned within a few months and began his literary career by contributing essays, novels and stories to French journals and magazines. He was elected to the French Academy in 1900 and was also an officer of the Legion of Honor. His works display his great ability as a character delineator but are at times too severely logical. They include ‘Les yeux verts et les yeux bleux’ (1886); ‘L'Inconnu’ (1887); ‘Deux plaisanteries’ (1888); ‘L'Exorcisée’ (1891); ‘Peints par eux-mêmes’ (1893); ‘L'Armature’ (1895), dramatized 10 years later by Eugène Brieux; and the series of plays: ‘Les paroles restent’ (1892); ‘Les Tenailles’ (1895); ‘Le loi de l'homme’ (1897); ‘La course du flambeau’ (1901); ‘Point de lendemain’ (1901); ‘L'Enigme’ (1901); ‘Théroigne et Méricourt’ (1902); ‘Le Dédale’ (1903), produced in New York as ‘The Labyrinth’; ‘Le réveil’ (1905); ‘Bagatelles’ (1912). See Labyrinth, The.

HERWEGH, her'vek, **Georg,** German political and lyrical poet: b. Stuttgart, 31 May 1817; d. Lichtenthal bei Baden-Baden, 7 April 1875. He studied theology at Tübingen, became editor of A. Lewald's periodical *Europa* at

Stuttgart; became embroiled with a military officer at Stuttgart and was obliged to flee to Switzerland, and settled there at Emmishofen in the canton of Thurgau. He there edited jointly with Wirth a periodical called *Die Volkshalle* and published a volume of political lyrics, 'Gedichte eines Lebendigen' ('Poems of a Living Man'); the title is in imitation of Prince Pückler's 'Briefe eines Verstorbenen' ('Letters of One Deceased') in 1841 (at Zürich; 10th ed., Stuttgart 1877). These poems showed considerable revolutionary spirit, yet on his journeys in Prussia (1842), he was favorably received, even by King Frederick William IV, who is said to have remarked «I respect opponents who have principles» and summoned him to an audience. From the city of Königsberg he addressed a strongly provocatory letter to the king, resulting in his banishment from Prussia; Zürich also, to which he wished to return, would not receive him. But the king of Württemberg pardoned him for desertion from military service. In the canton of Basle, of which he now became a citizen, he married Emma Siegmund, daughter of a Jewish merchant at Berlin. At Paris, where he lived for a number of years, he wrote the poems in the second volume of 'Gedichte eines Lebendigen' (Zürich 1844) and translated Lamartine's works into German (Stuttgart, 12 vols., 1843–44). He engaged in active revolutionary propaganda at Paris, and in April 1848 invaded Baden at the head of a Franco-German Workers' Legion, accompanied by his wife and A. von Bornstedt. His force was defeated at Dossenbach 27 April by the Württemberg troops, and he fled to Switzerland, aided by his courageous wife. He produced little in the remaining years of his life, except translations of several Shakesperean plays. His works were issued in a complete edition in German with biography and introduction by Hermann Tardel (3 vols., Berlin 1909); 'Neue Gedichte' (posthumous poems, Zürich 1877); Lassalle's, 'Briefe an Herwegh' (Zürich 1896). Consult Walzel, O., 'Vom Geistesleben des 18. und 19. Jahrhunderts' (Leipzig 1911).

JACOB WITTMER HARTMANN.

HERZEGOVINA, hĕrt-sĕ-gō-vē'nä, Austria-Hungary. See BOSNIA.

HERZL, hĕrts'l, **Theodor**, Hungarian journalist and dramatist: b. Budapest, 2 May 1860; d. Edlach, 3 July 1904. Associated largely with Vienna, where he had won his way as literary journalist and dramatist, he is chiefly known for his labors in behalf of Zionism (q.v.), which gained him international fame. He was deeply stirred by the persecutions of the Jews revived in his day in Rumania and Russia, and was in Paris as correspondent of the Vienna *Neue Freie Presse* during the Dreyfus affair, which further quickened his determination to help solve the modern Jewish problem. In 1896 he issued a pamphlet «Der Juden-Staat,» which soon appeared in English and other languages and gave impetus to Zionism, arousing singular enthusiasm chiefly among the masses in Europe and recent emigrants in America. He succeeded in organizing several international congresses at Basel «to establish a publicly and legally assured home in Palestine,» and gave his entire time and strength to carry out the plan. He was received by the sultan (1901), the Pope, the kaiser, and many leaders in Europe. England was ready (1903) to offer land in East Africa for the purpose, on the failure of his scheme to obtain a settlement in the Sinaitic Peninsula, adjoining southern Palestine. His energies, however, had been overtaxed and he died the following year. Of an attractive personality his period of leadership, although brief gave profound impetus to Jewish thought as to present and future conditions. His political Zionism has been hailed as the solution of the Jewish problem and attacked by its opponents as the dissolution of Judaism.

HESIOD, Greek poet: b. Ascra, a village of Bœotia, at the foot of Mount Helicon, whence it is called the *Ascraan*. But little is known of Hesiod with certainty. Even the age in which he lived cannot be precisely determined. Herodotus calls him a contemporary of Homer, and says they lived 400 years before himself (about 900 B.C.). In his 'Works and Days' (172) Hesiod says that he belonged to the period immediately following the Trojan War; but there are many reasons for supposing that he lived at a later period. His father emigrated from Cuma to Ascra where the poet was born, and where he spent his early days in rural pursuits. On his father's death, a dispute arose between Hesiod and his brother Perses concerning the father's property, which was decided in favor of the later. Hesiod then went to Orchomenos, where he remained for the rest of his life, and was buried according to tradition. A great number of anecdotes and stories have been handed down concerning his life. Among these is the tradition that there was a contest between Hesiod and Homer in which the former came off victorious. This story owes its origin doubtless to the strife between the Bœotian and Ionic schools of poetry, of which Hesiod and Homer were the respective representatives. Of the numerous works attributed to him three only remain. These are the 'Theogony,' a collection of the oldest fables concerning the birth and achievements of the gods, arranged so as to form a connected whole. It is the most important and difficult of all his works. With it was probably connected the lost 'Catalogues of Women' (or the *Eoiai megalai*), to the fourth book of which the second fragment (the 'Shield of Heracles') must have belonged. This is evidently composed of three distinct parts, only one of which is occupied with the real description of the shield. The third fragment is a didactic poem, 'Works and Days' (*Erga*, or *Erga kai Hemerai*). It treats of agriculture, the choice of days, etc., with prudential precepts concerning education, domestic economy, navigation, etc. Other works attributed to him are the epic story of 'Ægimius,' the ancestral hero of the Dorians; the epic 'Melampodia,' concerning the prophet Melampus, and 'Exegesis on Miracles.' Fragments of these are to be found in Göttling's edition of Hesiod. From a literary standpoint, the Hesiodic poems are far inferior to the Homeric. The former deal with the practical questions of actual labor, the bare genealogical account of the gods and the facts concerning the cosmogony of the universe. They are unimaginative treatises in poetical form, and their purpose, unlike the heroic recitations of the Homeric legends, is purely didactic, informative.

Contemporary as well as succeeding generations held these poems in high esteem as authoritative accounts, and many early scholars zealously wrote commentaries, explanations and criticisms, of which only a few later fragments have survived. Whether or not the Hesiodic works as they have come down to us are the original work of one man, or the elaboration by successive interpreters of a much shorter work, is difficult to determine, though there is much evidence in favor of the latter viewpoint.

Bibliography.— The first Greek text was printed at Milan (1493). The first edition with the Greek scholia appeared at Venice (1537), and later at Cologne (1542) and Frankfurt (1591). Other important editions are by Gaisford, T. (in Poetæ Græcæ Min.); by Göttling-Flach (1878); Paley, F. A. (with Eng. trans., London 1883); and Rzach, A. (1902). The ‘Works and Days’ has been edited by Van Lennep (1847) and Kirckhof (1889). The best English translations are by Thomas Cooke (London 1728) and A. W. Mair, (1908).

HESPERIDES (daughters of Hesperis), the guardians of the gold apples which Ge (the Earth) had given to Hera on her marriage. They were the daughters of Atlas and Hesperis, but their parentage is differently represented by other writers. They were four in number and their names were Agle, Arethusa, Erytheia, Hesperia, or Hesperarethusa. They were assisted in the charge of their garden by the sleepless dragon, Ladon. It was the twelfth labor of Heracles to bring the golden apples of the Hesperides to Eurystheus.

HESPERIDES, hĕs-pĕr'ĭ-dēz. The book of the collected lyrics of Robert Herrick, beautifully entitled ‘Hesperides,’ was published in 1648. Included in the volume, in addition to the secular lyrics, which number nearly 1,200, were 271 religious poems, separately entitled ‘Noble Numbers.’ The two collections comprise practically all of Herrick's characteristic work; it is to the «unbaptized rhymes» rather than to the «pious pieces» that he owes his fame as the most delicate and tuneful of English lyric poets.

The richly varied subject matter of Herrick's art is summed up in an introductory poem, «The Argument of His Book.» First in the list stands nature, in its individual objects of grace and beauty, and all the exquisite perceptions of the sense:

> I sing of brooks, of blossoms, birds and bowers,
> Of April, May, of June and July flowers.

Then come the customs, ceremonies and fairy fancies of the folk; then love and «cleanly wantonness,» and finally religion. Herrick is essentially a hedonist, delicately sensitive to beauty in all its myriad forms. He is the literary descendant of the ancient lyrists — of Anacreon, Horace and Catullus; and again of the Elizabethans, especially Ben Jonson, in the roster of whose «sons» he was proud to place himself. The qualities of his poetry are spontaneity, simplicity and a lyric grace which places him above all rivals. The deeper ranges of spiritual and moral experience were foreign to him, and the element of thought is almost entirely absent from his work, save for the ever-recurring idea of the shortness of life and the speedy decay of youth and beauty, which imparts a wistful melancholy to his verse. He counsels us, like Horace, to pluck the flowers of life while yet we may enjoy them. In his love poems Herrick is never deeply serious. The numerous girls he celebrates are for him like the lilies and violets and morning dews, of a beauty as exquisite and as fleeting. Hence he is almost entirely without the note of sensuality which characterizes the work of many of his contemporaries.

A few of Herrick's lyrics — «To Corinna Going a-Maying,» «To Daffodils,» «Gather ye Rosebuds,» etc.— are universally familiar, but he reaches as high a level in many others. The ‘Hesperides’ are a perpetual garden of delights, in which men may escape for the moment from «the strange disease of modern life» into a world of sunshine and pure beauty. Consult the ‘Works of Robert Herrick’ (ed. by Alfred Pollard, The Muses Library); Moorman, F. W., ‘Robert Herrick, a Biographical and Critical Study’ (1910).

JAMES H. HANFORD.

HESPERORNIS, hĕs-pĕ-rôr'nĭs, a remarkable extinct form of bird, the remains of which are met with in the Cretaceous deposits of Kansas. As described by Professor Marsh, it possessed small pointed reptilian teeth, which were implanted in a deep continuous groove, somewhat like those of Ichthyosaurus. Its brain was small and more reptilian in type than that of any adult bird as yet examined. It appears to have been a large diving-bird, measuring over five feet from the point of the bill to the end of the toes. Its wings were rudimentary, its legs powerful and its feet well adapted for rapid progression in water. The tail was broad, could move up and down, and was probably used as a rudder or swimming-paddle. The long slender jaws were united in front only by cartilage, as in serpents, and had on each side a joint which admitted of some motion, so that «the power of swallowing was doubtless equal to almost any emergency.» Consult Lucas, ‘Animals of the Past’ (1901).

HESPERUS, hĕs'pĕ-rŭs, among the Greeks the planet Venus, when it appeared as evening star, personified as the divinity that at weddings leads the bride to the arms of her husband. He is called Phosphorus or Lucifer as a morning star, and is styled the son of Eos (Aurora) and Cephalus. He was also known as son or brother of Atlas, and brother of the Hesperidæ.

HESPERUS PEAK, an elevation of the La Plata Mountains, in the southwestern part of Colorado. Gold and silver have been mined in the vicinity. This peak is one of a group of high peaks in the vicinity of the State; the height is about 13,135 feet.

HESSE, hĕs'se, Hermann (also known under the pseudonym HERMANN LAUSCHER), German novelist: b. Calw, Württemberg, 2 July 1877, the son of the editor of a religious journal, Johannes Hesse. He became a mechanic, later a bookseller at Basle, where he simultaneously attended lectures on literature and the history of art. In his choice of petty burgher subjects, as well as in his warmth of language and treatment, Hesse reminds one of the Swiss writers, particularly Gottfried Keller. Since

1905 he has been living at Gaienhofen, near Radolfzell, on Lake Constance. His delicate delineation of moods and milieus perhaps fits him better for the German short story (*Novelle*) than for the longer novel. In him, there are many reminiscences of Adalbert Stifter; his mood of recalling the events of childhood, which seems to be a constant preoccupation with him, yields him material for delightfully intimate treatment in three of his romances, ‘Hermann Lauscher,’ ‘Peter Camenzind,’ ‘Unterm Rad.’ He avoids the narrative of striking or impressive clashes of interest, preferring the more calm and peaceful life of the ordinary citizen. From ‘Nachbarn,’ a collection of short stories (1908), is taken ‘In the old «Sun»’ (translated into English in ‘The German Classics,’ Vol. XIX, New York 1914). His works include ‘Romantische Lieder’ (1898); ‘Eine Stunde hinter Mitternacht’ (1899); ‘Hinterlassene Schriften und Gedichte Hermann Lauschers’ (1901); under the title ‘Hermann Lauscher,’ (1908); ‘Peter Camenzind,’ novel (Berlin 1904; 50th ed., 1909); ‘Unterm Rad’ (1905); ‘Diesseits’ (1907); ‘Nachbarn’ (1908); ‘Gertrud’ (1908); ‘Umwege,’ short stories (Berlin 1912). Consult Kuhn, Alfred, ‘Hermann Hesse’ (Leipzig 1907).

JACOB WITTMER HARTMANN.

HESSE, hĕs, or **HESSIA** (German, HESSEN, hĕs'sĕn), Germany, an ancient territory inhabited in the time of the Romans by the Catti or Chatti, an old Germanic tribe. Under the Frankish kings Hesse was governed by counts, the principal of whom were the counts of Gudensberg of the name of Giso. Philip I the Generous, who succeeded to the sovereignty of the whole country in 1509, and who was the earnest and zealous friend of the Reformation, divided his dominions among his four sons. The eldest, William IV, obtained one-half, including the capital, Cassel; Louis IV one-fourth comprising Marburg; Philip II one-eighth, with Rheinfels; and George I also an eighth, with Darmstadt. But Philip dying in 1583, and Louis in 1604, without children, there remained only the main branches of Hesse-Cassel and Hesse-Darmstadt.

HESSE, Grand Duchy of (the GROSSHERZOGTUM HESSEN), a state of the German Empire lying between lat. 49° 24′ and 50° 51′ N. and long. 7° 51′ and 9° 39′ E. Its capital, Darmstadt, is a city of 87,089 inhabitants according to the latest official census, which gave the total population of the state as 1,282,051. The area is 2,968 square miles. It is divided into two main parts, which are separated by Prussian territory, and 11 smaller outlying parts. The southern main constituent part is divided by the Rhine into the Starkenburg and Rheinhessen (Rhenish Hesse) provinces, and is bounded on the north by Prussia, on the east by Bavaria and Baden, on the south by Baden and on the west by the Bavarian Rheinpfalz and Rheinpreussen. The northern chief division, called Oberhessen (Upper Hesse), lies wholly within Prussia. The outlying members of the state are: Wimpfen a. Berg, Wimpfen i. Tal, Hohenstadt, Helmhof (interpolated in Baden), Steinbach (surrounded by Prussian territory), several afforested districts belonging to the province of Oberhessen but situated in Prussian territory southwest of that province, etc. A further division is made for administrative purposes, according to which the provinces contain 18 Kreise (circles) and 983 communes. The fact that the members of this state are to such an extent dispersed, and that eight separate parcels of territory belonging to Prussia and Baden are enclosed by Hessian land, finds its explanation in the circumstance that the grand duchy represents the present sum of particular additions made from time to time at the expense of older countries (Katzenelbogen, etc.) and that since 1803 it has secured portions of Kunpfalz and Kurmainz, the bishopric of Worms, the abbey of Seligenstadt, the old imperial cities of Wimpfen, Friedberg and Worms and a part of the old French department of Donnersberg; moreover it now embraces the baronies or principalities of Isenburg, Solms, Schlitz, Erbach, Stolberg, Löwenstein-Wertheim, as well as the domains of the families of Riedesel, Wambolt, Gemmingen and Löw.

Topography.— The larger and much more densely populated lower chief division, comprising Starkenburg, with 1,169 square miles, and Rhenish Hesse, 530 square miles, although it is in a measure occupied by the Odenwald in the southeast, and to that extent resembles the rough country of Upper Hesse, has quite different characteristics in the west, the centre and the northeast where it extends into the fruitful valley of the Rhine or clings to the river Main southeast of Frankfurt and Offenbach. Rhenish Hesse includes the fertile and thickly settled country between Krewznach, Worms and Mayence (Mainz). On the other hand the Upper Hesse province, with 1,269 square miles, partakes of the geographical and topographical characteristics described in the article HESSE-NASSAU (q.v.). The rivers of the grand duchy belong to the Rhine system, except that the eastern parts of the Vogelsberg declivities send their streams to the Fulda. The principal river, the Rhine, enters the state at the cathedral town of Worms, divides (as we have said) Rhenish Hesse from Starkenburg province, then forms the boundary with Prussia and leaves Hesse at Bingen. Its tributary streams, touching or flowing through Hesse, are the Neckar, which divides Starkenburg province from Baden for a short distance; the Weschnitz; the Main (navigable where it forms the boundary with Prussia); the Mümling and the Lahn, the Salz and the Nahe. Tributary to the Fulda are the Schlitz and the Schwalm. In each of the three provinces there are mineral springs, of which the most widely known are the Sauerquellen at Schwalhein, the (Saline) Bad-Nauheim and Bad-Salzhausen in Upper Hesse. The climate in the southern valleys and plains is mild and well suited to the cultivation of fruits; in the mountainous districts, on the other hand, it is so much harsher, that only hardy crops are grown above a moderate altitude.

Population.— The inhabitants (439 per square mile) are by derivation principally West Franks of the Upper or North German race. The ratio of males to females is as 1,000 to 1,006. About two-thirds are Protestants (66.63 per cent, according to an authoritative statement); Roman Catholics, 30.49 per cent; other Christian denominations, 0.67 per cent; Jews, 2.19 per cent. In the years 1843–67, 1871–75 and 1880–85 large numbers of the inhabitants emigrated to other countries, but that tendency has decreased since 1894 to a very large extent. As the basic principles of the elaborate educational system, instruction is compulsory and the state contributes to the support of elementary schools. Public elementary schools number 979, with 215,709 pupils, 3,469 male and 584 female teachers. Schools of the next higher grade had 27,522 pupils a year or 18 months before the European War began; and at that time there were 11 gymnasia, two progymnasia, three realgymnasia, nine oberrealschulen and the same number of realschulen, an agricultural college, 32 superior Bürgerschulen, with 739 teachers and 12,584 pupils, six higher schools for girls with 3,523 pupils, and 49 private schools with 3,790 pupils; the University of Giessen then having 1,436 under-graduates; the Technical High School at the capital, 1,347. The foregoing enumeration, though not complete, gives a fair idea of the educational system's scope.

Agriculture and Mining.— By means of insurance organizations, agricultural societies and institutes for instruction, the important agricultural interests are sustained and promoted by the local government as well as by individuals in private life. The cultivation of fruits is very profitable in all three provinces; especially noteworthy are the vineyards of Rhenish Hesse and some other localities — the wines of those regions figuring largely among exports. Mining plays a larger part in Upper Hesse than in the other two provinces, the chief products being iron, manganese, soft coal or coke, and salt; and in this matter also both he state and private individuals are participants. The quantity of coal produced during he year before the war was 397,520 tons.

Industrial Activity.— Complete industrial freedom has been the rule since the adoption of he German regulation of industries; but ex- eptions are noted in the conduct of certain oc- upations (those of the apothecary, the tavern- eeper, etc.) which are made dependent upon oncessions or licenses. Manufacturing indus- ries in their many varieties support more than 8 per cent of the total population; the principal manufactures being chemicals, leather, cloth, aper, furniture, wagons, railroad cars, musical instruments and machinery.

Government.— The sovereign grand duchy, which attained that dignity in 1806, was up to 918, in accordance with the constitution of 7 Dec. 1820, which had undergone many hanges, an "indivisible constitutional mon- rchy," at the head of which stood the Grand uke (Grossherzog von Hessen und bei Rheim) ho had also the title Königliche Hoheit royal or regal highness) and was titular head f the Evangelical Church of the duchy as well. is civil list was about $316,000, and he divided w-giving power with the nobility and repre- ntatives of the people in the Landständen, hich was composed of first and second houses chambers. The judiciary (including a high urt at the capital and Landgerichte at Darm- adt, Giessen and Mainz) maintained its dis- ict existence although the head of the depart- ent of justice was the Minister of State who as also Minister of the Grand-Ducal House d Foreign Affairs.

Finance.— For the year 1915–16 the ordinary revenue and expenditure were estimated to balance at $22,736,925, leaving a deficit of $1,143,415, approximately. The public debt, nearly all for railroads, was stated at $112,215,505, approximately, in 1914.

HESSE-CASSEL, hĕs-kăs'ĕl, or **ELECTORAL HESSE**, Germany, a former electorate and independent member of the Germanic Confederacy, between Rhenish Prussia and Bavaria, containing 4,430 square miles, with about 850,000 inhabitants, mostly Protestants. It was founded by the eldest son of Philip the Generous, the Landgrave William IV, surnamed the Wise (1567–92). For a long period the history of Hesse-Cassel was a narrative of conflicts between the people for political freedom and the Elector for absolute rule. The demands of the people were on several occasions strengthened by appeals to the Elector from the Prussian government. On the outbreak of the German war of 1866, the Elector joined Austria, and his territory was occupied by Prussian troops. On the conclusion of the war Hesse-Cassel was annexed to the Prussian territories, and now forms part of Hesse-Nassau (q.v.). Consult Gräfe, Heinrich, 'Der Verfassungskampf in Kurhessen' (Leipzig 1851); Rommel, Christopher, 'Geschichte van Hessen' (10 vols., Cassel 1820–58); Sybel, H. von, 'Die Begrundung des deutschen Reichs durch Wilhelm I' (Munich 1889–94, Eng. trans., New York 1889–94); Wippermann, C. W., 'Kurhessen seit dem Freiheitskriege' (Cassel 1850).

HESSE-DARMSTADT. See Hesse, Grand Duchy of.

HESSE-HOMBURG (Hessen-Homburg), Germany, former landgraviate comprising the districts of Homburg vor der Höhe and Meisenheim on the right and left bank of the Rhine respectively, with an area of about 106 square miles. It was anciently a part of Hesse-Darmstadt, but became a separate land graviate in 1768. From 1806 to 1815 it was again an integral part of Hesse-Darmstadt. In the latter year its independence was restored by the Congress of Vienna and its territory increased by the addition of Meisenheim. Baths and springs were opened at Homburg in 1833 and became a principal source of revenue to the state. Gambling also prevailed and was with difficulty kept within bounds until 1872. A liberal constitution was granted in 1848, but appears to have never been in effect. In 1866 on the death without issue of the last Landgrave, Ferdinand, the territory was divided, Meisenheim going to Prussia and the landgraviate to Hesse-Darmstadt. Later in the same year (3 Sept. 1866) it was ceded to Prussia because of its having sided with Austria in the conflict with the former, and became a part of the Prussian province of Hesse-Nassau. Consult Herget, 'Das landgrafliche Hans Homburg' (Homburg 1903).

HESSE-NASSAU, hĕs'năs'â, or **HESSEN-NASSAU**, hĕs'sĕn-năs'sow, Germany, province of Prussia, which includes the former electorate (Kurfürstentum) of Hesse-Cassel (except some small districts), the greater part of the former duchy of Nassau, that portion of the former landgraviate of Hesse-Homburg which lies on the right bank of the Rhine, the territory and town of Frankfort-on-the-Main, and some small districts ceded by the grand duchy Hesse and Bavaria. It was formed in 1867–68 out of the foregoing regions, which were annexed by Prussia as a result of the War of 1866. The province is bounded by the Prussian provinces of Westphalia, Hanover, Saxony and the Rhine-province, the principality of Waldeck, the grand duchy of Saxe-Weimar and the kingdom of Bavaria; area, 6,060 English square miles, divided into the two governments (Regierungsbezirke) of Cassel and Wiesbaden. The greater part of this province has a rugged surface, with only small and scattered areas of lowlands or valleys.

Topography and Climate.— In the Wiesbaden governmental division the highlands belong to the Rhenish-Westphalian mountain system, a branch of which extends like a peninsula between the new red-sandstone formations of the Cassel governmental division; and in the former division we find the Taunus and Westerwald, with the Feldberg and the Fuchskauten as the highest points. Predominant in the latter division (Regierungsbezirke) are the red-sandstone mountains of the Rhenish system, including the high Rhön with the Wasserkuppe and the Milseburg, etc. In the northern part of the province a great number of mountains, either separated or in relatively small groups, form the Hessian highlands, the altitude of the peaks ranging from 1,235 feet, in the Lahnberge near Marburg, to 2,054 feet in the Knüllgebirge, between the Fulda and the Schwalm, the heights of the Seulingswald between the Werra and the Fulda; north of these the Richelsdörfer Mountains and northeast the Ringgau Mountains; the Bombacher Wald and the Alheimer toward the west, etc. The Söhre, the Meissner and the Kaufunger forest lie farther toward the north; the Langenberg, the Reinhardtswald and the Habichtswald extend north and south between the Weser, the Fulda, Diemel and Eder. New red-sandstone constitutes the basis of these mountain-regions; only in rare instances is it covered with shell-lime. Basaltic columnar formations, however, occur in many localities, and in a noteworthy degree are interpolated among Tertiary formations between Cassel and Ziegenhain. The Thuringian Forest occupies a part of Schmalkalden, and in Rinteln are segments of the Weser Mountains; the most conspicuous point in either of these governmental «circles» being the Inselsberg (2,977 feet). As a whole, Hesse-Nassau belongs to the Weser and Rhine river-systems. The navigable larger rivers — in the south the Main and Rhine, and in the north the Werra and the Weser — are to be regarded as border or boundary streams; among those penetrating the territory of the province and more closely identified with it are the Kinzig, the Nidda, the Ohm, the Ems, the Weil, the Aar, the Elbbach, the Dill, the Eder, the Schwalm, the Diemel and (especially important) the Fulda and the Lahn. In the Rhön Mountains and the Westerwald the climate is particularly harsh, these regions being covered with great masses of snow during nearly one-half of the year; on the other hand climatic conditions in low-lying districts are decidedly favorable.

Population and Education.— The number of inhabitants according to the last official census was 2,221,021, or 366.5 per square mile. Protestants are about two and one-half times as numerous as Roman Catholics, and there are about 50,000 Jews. The institutions of learning are The University of Marburg, 20 gymnasien or colleges, one progymnasium, four realgymnasia and an equal number of realprogymnasia, six oberrealschulen, 14 realschulen, one agricultural school, four private schools of the higher-grade, seven normal schools for men and women teachers, three institutions for the deaf and dumb, two for the blind, etc.

Industries.— The inhabitants are chiefly employed in farming, cattle-raising, forestry and mining. About 45 to 46 per cent of the total area is devoted to arable fields and gardens; 11.6 per cent to meadow land; 0.2 to vineyards; 39.7 per cent to forest. In this province, which is the forest-region par excellence of Prussia, the principal trees are the beech, oak, fir and pine; forests covering both slopes and crests of the mountains with the exception of the highest parts of the Westerwald and the High Rhön. Although this province is not very well adapted to agriculture, fertile areas are found near such rivers as the Main, the Ems, the Schwalm; moreover, the meadows are utilized very generally for stock-farming. In the neighborhood of Cassel, fruit and garden vegetables are cultivated very profitably; and the same may be said on districts on the Werra, the Rhine, the Lahn and the Main. A pomological institute and nurseries on a grand scale are maintained at Geisenheim. For the cultivation of the vine the hills of Rheingau are famous; and in this province are found those centres or wine-production, Hochheim, Rauenthal, Erbach, Johannisberg, Geisenheim, Assmanshausen and Rüdesheim. The mines yield iron ores, coal, copper, manganese and lead. Mineral springs — particularly those of Ems and Wiesbaden, of Niederselters, Geilnau and Fachingen, contributed before the war in an important degree to the prosperity of the province, the waters of many springs being exported; and an important source of income has been the throng of foreigners visiting Wiesbaden and Ems and the well-known baths (Soden, Homburg, Langenschwalbach and Schlangenbad). Manufactures are important only in a few regions, for example: the city of Cassel (machinery, gold and silver ware and instruments of many kinds), Grossalmerode, Eschwege (leather and sole-leather from South American hides), Frankfort-on-the-Main (jewelry, iron and bronze wares, machines and chemicals). Other industrial establishments are those devoted to weaving, the manufacture of paper, etc.

The governmental district of Cassel is divided into 24 «circles,» and that of Wiesbaden into 18, the Oberpräsident exercising his authority as the chief representative of the Imperial government at the city of Cassel. In that city are located also the supreme courts (Oberlandesgericht) and one of the three provincial or general courts of justice of the Cassel district, the other two being at Hanau and Marburg. In Frankfort-on-the-Main there is also an Oberlandesgericht and one of five general courts, the other four being at Limburg, Hechingen, Neuwied and Wiesbaden. The province sends 14 members to the German Reichstag and 26 to the Prussian Chamber of Deputies. The Cassel governmental district belong to the circuit of the 11th army corps; the Wiesbaden district falls within the jurisdiction of the 18th army corps. The most important among the lines of railroad is that from Göttingen to Cassel and Frankfort-on-the-Main.

HESSEN-DARMSTADT, hĕs'sĕn-därm'-stät. See Hesse, Grand Duchy of.

HESSIAN FLY. See Wheat Insect Pests.

HESSIANS IN THE REVOLUTION, The. In the 18th century Germany was divided into nearly 300 sovereignties, each maintaining a court and a military force. The possible revenue was often very limited, the burdens were almost intolerable and the princelings were often profligate and cruel; they did not need their forces for home defense, and were glad to make money for themselves by letting out their regiments for hire, though except in one case they remitted no taxes on the people from the receipts. There was also a lingering tradition that soldiering was an honest trade like any other and that it was useful for helping sovereigns to keep order; especially to put down insurrections, which were wicked. This, however, did not apply to rulers hiring out their troops and pocketing the money; and not only the liberal school of writers and public men, but enlightened despots like Frederick the Great, denounced it. But England had not sufficient army for the American War, and wished drilled troops rather than raw recruits and after vainly endeavoring to hire 20,000 Russian soldiers, turned to the German princes, with some of whom she had dynastic relations and all of whom were so eager to sell their wares that two of them offered soldiers for hire immediately after Bunker Hill, without waiting to be asked. Only those which could furnish considerable numbers were worth treating with and all the German auxiliaries were finally hired from six states; about half being from two Hessian states, and by far the largest (more than three times greater than any other) from one. All were indiscriminately termed “Hessians,” as all German immigrants were formerly called “Palatines.” The first treaty was made with the Duke of Brunswick, 9 Jan. 1776, for 4,300 troops; reinforcements or replacements were sent year by year, till the total had amounted to 5,723, only 2,708 of whom ever returned. The second was with the Landgrave of Hesse-Cassel, 15 Jan. 1776, for 12,805; finally increased to 16,992, of whom 10,492 returned. The contingents from the others, under various treaties, amounted to — Hesse-Hanau, 2,038; Anspach-Baireuth, 2,353; Waldeck, 1,225; Anhalt-Zerbst, 1,152. Total sent to America, 29,867, of whom 17,313 returned; the rest either died or remained as citizens. There were about 20,000 in America at any one time after 1776. These forces cost Great Britain in subsidies and incidentals about £1,770,000; besides the lump sum, it was obliged to replace the dead, and at least in one case count three wounded men as one dead one.

About 18,000 were shipped in 1776; the commander-in-chief was Lieut.-Gen. Philipp von Heister, a veteran of the Seven Years' War. The first division of some 8,000 landed at Staten Island 15 August; they included a body of chasseurs and grenadiers under Lieut. E. W. F. von Donop, an able and daring officer. They took a leading part in the battles of Long Island and White Plains, and all the operations for capturing New York; and stormed Fort Washington with a loss of 56 killed and 276 wounded. During this time the second division of about 4,000, under Lieut.-Gen. Wilhelm von Knyphausen, joined them. Washington's surprise at Trenton fell on Colonel Rall's brigade of Germans. Rall was a regular officer whose contempt for the ragged Americans surpassed that of the most arrogant Briton, and he refused to take the most elementary precautions; he was mortally wounded. Early in 1777 Heister was superseded by Knyphausen; Howe finding the former intractable and the Landgrave of Hesse laying the blame of Trenton upon him. Meantime the Brunswickers and a Hanau regiment under Baron von Riedesel had made a clearance of Canada; and in 1777 they were joined to the expedition of Burgoyne, in whom Riedesel had no faith. It was from this division that Baum's detachment was sent off to raid Vermont and to meet its fate at Bennington, with Breymann's sent to support it; 365 of Baum's 374 Germans did not return, and 231 of Breymann's were killed, wounded or captured. Riedesel and his remaining men shared in Burgoyne's surrender. Around Philadelphia, at Brandywine and Germantown, Knyphausen's command was of the first importance; and at Red Bank Donop tried to storm the American fort and was mortally wounded, his command losing 82 killed and 229 wounded besides 60 prisoners. In the three years' occupation of Rhode Island, from the fall of 1776 to that of 1779, about half of the British corps was Hessians; and they liked, and were liked by the inhabitants — when they departed, all persons, but especially women, were prohibited from appearing at the Newport windows, in fear that the soldiers might not wish to go. In the South, at Savannah, Charleston, Pensacola, Baton Rouge, etc., they left many dead; and shared in the bloody drawn battle of Guilford Court House. Finally, at Yorktown, they bore the brunt of the actual fighting, losing 53 killed and 131 wounded.

The Germans did their duty bravely and faithfully, with loyalty to a service they had been sold into to no profit of theirs. Very few deserted, in spite of constant inducements held out to them; a policy which Washington strongly deprecated. Probably one reason was, that they were at once recognizable from their speech. Nor were they in the least inhumane or rapacious: the charge that they were cruel barbarians was a mere political weapon of the time. In a strange country, they would have run the risk of being murdered in reprisal had they been such; but in fact they appear to have been well-meaning men. Of the 29,867 who came over, only 17,313 returned to Germany. Of the 12,554 remaining, 548 were killed; some of the total 1,652 wounded died; some disappeared; but a great number are known to have remained and settled in the country. Grants were given them in Nova Scotia, but many scattered as chance directed. Consult Lowell, ‘The Hessians in the Revolution’ (1884).

HESSITE. A mineral consisting of silver telluride, Ag_2Te, containing 63.3 per cent of silver. Has been mined in La Plata County, Colo., and in California and Oregon.

HESTIA. See Vesta.

HESYCHIUS, hĕ-sĭk-ĭ-ŭs, the author of a Greek lexicon, which has probably come to us in an abridged form, and which he partly collected from former dictionaries, and partly enlarged by many new words and examples from Homer, the dramatic and lyric poets, the orators, physicians and historians. He was a native of Alexandria, and according to the best authorities flourished about the end of the 4th century after Christ. Of the circumstances of his life nothing is known. His lexicon possesses great value, especially of an antiquarian kind, and is the most useful for the study of the Greek language of all the ancient critical writings that are extant. The best editions of his lexicon are Alberti and Ruhnken's (Leyden 1746–66, 2 vols. folio), and that prepared by Schmidt (Jena, 5 vols., 1867–68; in a smaller form, two parts, 1864; 2d ed., 1867).

HETÆRA, hĕ-tē'rạ (Greek *hetaira,* a female companion), the name given by the Greeks to a mistress, as opposed to a lawful wife. But the word had various shades of meaning, from a mistress, who might be a wife in all but the legal qualification of citizenship, down to a harlot. The beauty and accomplishments of many of the hetæræ occasioned their society to be sought by men of the highest eminence, even Plato and Socrates. No shame was attached to associating with them. Aspasia, the mistress of Pericles, is the most renowned of these hetæræ. (See Aspasia). Hetæræ, less intellectually famous, were Lais, whom Aristippus the philosopher loved, Phryne and others. They also became famous for their connection with the works of art. Praxiteles made a marble and gold statue of the latter, and she was also the model for his statues of Aphrodite.

HETEROGAMY. See Metagenesis.

HETEROGENESIS, hĕt″ë-rō-jĕn'ĕ-sĭs, or **HETEROGENY.** See Metagenesis.

HETEROPODA, hĕt-ĕ-rop'ō-dạ, a group of small, pelagic, pectinibranch mollusks, which dwell together in the open sea, have the foot modified into a swimming organ and are provided with a ventral sucker. The shells are spiral or shaped like that of an argonaut and seem as if composed of thin glass; indeed, the whole animal is beautifully transparent. Heteropods occur in enormous abundance at the surface of the sea in all the warmer parts of the world, and their dead shells sinking to the bottom form a large constituent of the abyssal ooze. They are highly organized, have well-developed eyes and other organs of sense, are bisexual and produce eggs in long cylindrical cords. The young in their development pass through a trochosphere and then a veliger stage. All are predatory, seizing and feeding on the numerous minute forms of life about them. They are most active in the early evening, darting about with twisting motions like worms, usually on their backs. They use the ventral sucking-disc for attaching themselves to any object they may encounter. Three families, containing many species, are known, and their closest affinities are with the petropods. Consult Kingsley, 'Standard Natural History' (Vol. I, 1885).

HETEROPTERA. See Hemiptera.

HETH, Henry, Confederate general: b. Chesterfield County, Va., 16 Dec. 1825; d. Washington, D. C., 27 Sept. 1899. Upon graduating at West Point in 1847 he was appointed second lieutenant, fought in the Mexican War and later against the Indians on the frontier, and became captain in 1855; but on the outbreak of the Civil War entered the service of the Confederacy, being commissioned major 26 March 1861 and colonel of the 45th Virginia Infantry, 17 June 1861. On 6 Jan. 1862 he became brigadier-gneral, fought through the West Virginia campaign, was assigned to A. P. Hill's division of the Army of Northern Virginia, was wounded at Chancellorsville, and on 24 May 1863 was commissioned major-general. As commander of a division of the Confederate army he rendered efficient service at Gettysburg, where he was again wounded; distinguished himself at Bristoe Station, Spottsylvania, Bethesda Church, Petersburg, Reams' Station and other places; and surrendered at Appomattox, 9 April 1865. After the war he engaged in mining operations for a time, then in the insurance business at Richmond, Va., and later became personal adviser to President Grant in relation to alleged Indian frauds. He wrote 'Memoirs of the War.'

HETMAN (Russian, *Ataman*), chief of the Cossacks, formerly elected by that people. He had the power of life and death, and was head of the army in time of war. Mazeppa in 1708 revolted against Russia, taking the side of Charles XII of Sweden, and Peter the Great abolished in consequence the power and authority of the hetman. Catharine II suppressed the office and title in the province of Ukraine; it still exists among the Cossacks of the Don. In Poland the commander-in-chief of the army was styled hetman, and was appointed by the sovereign. The last elective hetman of the Cossacks in Russia was Platorf 1812–14. On his death the grand duke, heir to the throne, was made hetman.

HETTY SORREL, in George Eliot's 'Adam Bede' (1859), a dairymaid whose unfortunate career, condemnation to death, and final reprieve form an important part of the story.

HEVELIUS, Johannes, yō-hạn'nĕs hā-fā'lē-oos, or hĕ-vē'lĭ-ŭs, known also as Johannes Hevel, Polish astronomer: b. Dantzic, 28 Jan. 1611; d. there, 28 Jan. 1687. After visiting the principal countries of Europe he settled in his native city, and from 1639 till his death applied himself almost exclusively to the study of astronomy. His 'Selenographia,' or description of the moon, published in 1647, was the first of numerous astronomical works of great value and authority on his favorite science. Halley, who visited Hevelius at Dantzic at the request of the Royal Society of London, of which Hevelius had been elected a member in 1664, reported favorably of the correctness of his observations. In 1661 he observed a transit of Mercury, a triumph confined to Gassendi alone of all preceding astronomers. Hevelius ranks next to Flamsteed among the men of his day as a diligent and accurate observer of the heavens.

HEWES, hūz, **Joseph,** American patriot: a signer of the Declaration of Independence: b. Kingston, N. J., 1730; d. Philadelphia, 10 Nov. 1779. He was educated at Princeton College, and about 1760 he removed to Edenton, North Carolina. He soon became a member of the colonial legislature, and was a delegate to the General Congress at Philadelphia 1774–77 and again in 1779. After taking his seat he was appointed on a committee to «state the rights of the colonies in general, the several instances in which those rights are violated or infringed, and the means most proper to be pursued for obtaining a restoration of them,» and aided in the preparation of its report.

HEWETT, hū'ĕt, **Waterman Thomas,** American Germanic scholar: b. Miami, Mo., 10 Jan. 1846. He was graduated from Amherst College in 1869, studied in Europe and was professor of German language and literature at Cornell University from 1870 to 1910, when he became professor emeritus. He has resided in Europe since 1913, in Oxford since 1914. He has been general editor of Macmillan's ‘German Classics’ since 1895, and beside frequent contributions to periodicals has published among other works ‘The Friesian Language and Literature’ (1879); ‘The University of Leiden’ (1881); ‘University Administration’ (1882); ‘The Aims and Methods of the Collegiate Study of the Modern Languages’ (1884); ‘The Present Condition of Instruction in the Modern Languages in American Colleges’ (1885); ‘The House of Orange’ (1885); ‘Introduction to the Life and Genius of Goethe’ (1886); ‘Wilhelm Scherer’ (1887); ‘The Mutual Relations of Colleges and High Schools’ (1887); ‘The Revised Constitution of the Netherlands’ (1887); ‘The Study of Modern European Literature in America’ (1887); ‘Ministers and Sovereign in Germany’ (1888); ‘Homes of the German Poets’ (1889); ‘History of Cornell University’ (1894); ‘Matthias de Vries and his Contributions to Netherland Philology’ (1895); ‘University Life in the Middle Ages’ (1898); ‘Sources of Goethe's Printed Text’ (1898); ‘The Historical Use of the Relative Pronouns in English Literature’ (1904); ‘Cornell University: A History’ (3 vols., 1905); and editor of ‘A German Reader’ (1899); Goethe's ‘Hermann and Dorothea’ (1891); same for colleges and high schools (1907); ‘Bibliography of the Writings of Goldwin Smith’ (1916).

HEWIT, hū'ĭt, **Nathaniel Augustus,** American Roman Catholic clergyman: b. Fairfield, Conn., 27 Nov. 1820; d. New York, 3 July 1897. He was graduated from Amherst College in 1839 and was for several years in the Episcopal ministry. He became a Roman Catholic in 1846 and joined the Order of Redemptorists. He was later one of the founders of the Congregation of Saint Paul (Paulists), taking the religious name of «AUGUSTINE FRANCIS,» and subsequently becoming professor and superior in the Paulist Seminary, New York. He wrote ‘Life of Princess Borghese’ (1856); ‘Problems of the Age’ (1868); ‘Light in Darkness’ (1871), etc.

HEWITT, Abram Stevens, American manufacturer and politician: b. Haverstraw, Rockland County, N. Y., 31 July 1822; d. New York, 18 Jan. 1903. He was graduated from Columbia in 1842 at the head of his class, and in 1843 he was made acting professor of mathematics there; he also began the study of law, and was admitted to the bar in 1845. He did not practise, however, but shortly after went into the iron and steel business with his father-in-law, Edward Cooper. By careful and skilful management he built up the financial success of his firm (Cooper & Hewitt); which was the first to manufacture iron girders and supports for fire-proof buildings and bridges, and also furnished the government with large quantity of material during the Civil War. In dealing with his employees, he was particularly successful, never having any serious trouble; it was his policy to keep the works running and the men employed, at least part of the time during dull seasons, though the business was sometimes carried on at a loss. At the time of his death he was recognized as one of the foremost iron masters in the country, his firm controlling the Trenton Iron Company and the New Jersey Iron and Steel Company. He organized the Cooper Union Institute (q.v.), and as the secretary of the board of trustees largely shaped and controlled its policy for a number of years. He also gave largely to the institution. He was first active in politics at the time of the reorganization of Tammany Hall after the overthrow of the Tweed Ring. He served in Congress 1874–78, and again 1880–86 and was always especially prominent in all matters pertaining to finance, advocating a low tariff and the gold standard. In 1876 he was chairman of the Democratic National Committee, and immediately after the election issued a proclamation to his party stating that Tilden had been elected; later he supported the policy of Tilden which resulted in the appointment of the Electoral Commission (q.v.). In 1886 he was nominated for mayor of New York by Tammany and other Democratic organizations and after a hard campaign won the election over Henry George and Theodore Roosevelt. As mayor he gave the city a most efficient administration, but his independent policy often antagonized the Tammany leaders, especially his strict enforcement of the excise law. He was not renominated by his party, and was defeated as a candidate on an independent ticket in 1888. While mayor he urged in one of his annual messages the need of improvement of the city's rapid transit, and advocated municipal ownership; though his suggestions were not heeded at the time, he continued his interest in the subject, and it was largely due to his efforts that recent improvements in that direction were undertaken; in recognition of his services the Chamber of Commerce presented him with a gold medal in 1901. In February 1903 a number of prominent citizens of New York set on foot a movement to raise a memorial fund of $500,000 to be presented to Cooper Union as the «Abram S. Hewitt Endowment of the Cooper Union.»

HEWITT, John Napoleon Brinton, American ethnologist and linguist: b. on the Tuscarora reserve, Niagara County, N. Y., 16 Dec. 1859. He is partly of Tuscarora descent and learned the language of that tribe while a child. He was educated in public schools at Wilson and Lockport, and was for some years farmer and journalist. After 1879 he assisted Mrs. Erminie Smith (q.v.) in the linguistic researches she was making for the Bureau of Ethnology on the Tuscarora reserve, and he is now employed in linguistic work at the Smithsonian Institution.

HEWITT, Peter Cooper, American capitalist and inventor: b. New York, 1861. He is the son of Abram S. Hewitt (q.v.) and grandson of Peter Cooper, was educated at Stevens Institute, Hoboken, and Columbia College. He entered business with his father, became a director of Cooper, Hewitt & Company and of the Cooper, Hewitt Electric Company, and of several other corporations. He is a trustee of Cooper Union and of the House of Rest, and member of the American Institute of Electrical Engineers, of the Illuminating Engineering Society, and other learned bodies. He invented improvements in the processes of the Peter Cooper glue factory, which the Hewitt firm controls. Turning his attention to electricity he invented the Cooper Hewitt lamp and static converter. The lamp in its present form consists of a glass tube of any desired shape with a bulb at one end which contains a small quantity of mercury. All air is exhausted from the tube, which thereupon fills with vapor from the mercury in the bulb. Electrodes are provided at each end of the lamp, the negative electrode in the bulb of mercury and the positive electrode at the opposite end. On passing a direct current through the lamp the vapor which fills the tube is rendered incandescent and gives off a steady, blue-white light. Owing to the great resistance at the negative electrode to the initial flow of current, it is necessary to use a high voltage to start the lamp. This is commonly done by passing a spark from a "choking" coil through the negative electrode, which when once penetrated offers but slight resistance to the flow of current. If for any reason the current is interrupted, the high resistance is immediately resumed and must be broken down again before permitting further flow of current. The light given off by this lamp is entirely lacking in red rays, and consequently does not reveal the real color of the objects it falls upon. It is, however, of great value as a photographic illuminator, being rich in actinic rays, which most affect the photographic plate. Mr. Hewitt is investigating with a view to discover means to turn some of the rays of the incandescent vapor into red rays. This discovery will be a means of great economy, because the Cooper Hewitt lamp is probably the cheapest artificial light in the world. The mercury vapor lamp consumes one-half watt per candle-power, as against three and one-half watts in the incandescent lamp. He invented also a mercury vapor rectifier, which greatly simplified the reduction of alternating current to direct storage batteries. He is also inventor of several mechanical appliances and of an improvement in wireless telegraphy by means of mercury vapor in a vacuum.

HEWLETT, hū'lĕt, **Maurice Henry,** English novelist: b. London, 22 Jan. 1861. He was the son of Henry Gay Hewlett, a writer of some little note, and was educated at the London International College, Isleworth. He was admitted to the bar in 1891, and in 1896–1900 was keeper of the land revenue records and enrolments. His reputation was made as an interpreter of the more recondite phases of the life and thought of the Middle Ages, especially in Italy. His style is a skilful medium for his purpose, but frequently so archaized as to be somewhat difficult. His principal works are 'Earthwork out of Tuscany' (1895), a collection of Italian studies; 'The Masque of Dead Florentines' (1895); 'Songs and Meditations' (1897); 'Pan and the Young Shepherd' (1898); 'The Forest Lovers' (1898), his first popular success; 'Little Novels of Italy' (1899); 'Richard Yea-and-Nay' (1900); 'New Canterbury Tales' (1901); 'Fond Adventures' (1904); 'The Stooping Lady' (1907); 'Half Way House' (1908); 'Artemision: Idylls and Songs' (1909); 'Brayenhead the Great' (1911); 'Helen Redeemed' (1913); 'Bendish: a Study in Prodigality' (1913); 'A Lover's Tale' (1915); 'The Little Iliad' (1915); 'Thorgils of Treadholt' (1917).

HEXAMETER (from the Greek ἕξ, six, and μέτρον, a measure), a verse of six feet. It is the heroic or epic measure of the Greeks and Romans, the finest examples of which are the two poems ascribed to Homer, the Iliad and the Odyssey, and the Æneid of Virgil. The sixth foot is always a spondee (two long syllables) or a trochee (a long and a short). The five first may be all dactyls (one long syllable and two short), or all spondees, or a mixture of both. The scheme of this verse then is —

—⏑⏑, —⏑⏑, —⏑⏑, —⏑⏑, —⏑⏑, ——
——, ——, ——, ——, ——, —⏑

with all the varieties which the mingling of the two kinds of feet, as mentioned, affords; as,

—⏑⏑, ——, ——, —⏑⏑, —⏑⏑, ——
Forte sub arguto consederat ilice Daphnis;
or, —⏑⏑, ——, —⏑⏑, —⏑⏑, —⏑⏑, ——
Qui Bavium non odit amet tua carmina, Mævi;

and so on. The variety of which the hexameter is susceptible, its great simplicity, its harmony, and its numerous pauses, constitute the charm of this verse, and adapt it to the most various subjects. A spondee is rarely used in the fifth foot, and then in Latin the word with which the verse ends is generally composed of four syllables, and the fourth foot at least must be a dactyl; as,

Cara deûm soboles, magnum Jovis incrementum.

The prevalence of the dactyl or spondee in the hexameter depends much upon the genius of the language; thus the dactyl is more frequent in Greek than in Latin, and in German than in Greek. It is evident that the hexameter cannot be formed in such languages as Italian, French, Spanish and English, whose prosody is regulated by the accent and not by the *quantity* of the words.

The French and Italian writers, however, early attempted the hexameter, as well as Sidney and Southey in English; but without success. More recent English poets have also tried it, as Clough and Kingsley. Longfellow has made use of the hexameter in his 'Evangeline.' But in no modern European language have hexameters become naturalized, except in German, to which this measure seems as well adapted as to the Greek. Fischart attempted the German hexameter in the 16th century. In the middle of the 18th century it was used by Klopstock, Uz, and Kleist. Goethe's hexameters are very often as poor as their sense is beautiful. John Henry Voss improved the German hexameter by the excellent translation of Homer and his valuable ‘Zeitmessung der deutschen Sprache’ (Königsberg 1802). See PROSODY; VERSIFICATION.

HEXAPLA. See BIBLE, VERSIONS.

HEXAPODA, hĕk-săp'ō-da, a group name for the six-footed arthropods, or true insects (*Insecta*), excluding spiders, myriapods and other forms often included in the term “insects.”

HEXATEUCH. See PENTATEUCH.

HEXOIC ACID, an organic acid having the formula $C_6H_{12}O_2$, or $C_5H_{11}COOH$, and occurring in fats, in cheese, among the products of the butyric fermentation of sugar, and in the fruit of *Heracleum sphondylium* and in the flowers of *Satyrium hircinum*. It is best prepared by the fractional distillation of crude fermented butyric acid. It is an oily substance, very clear and mobile, solidifying at about 29° F., and boiling at 400° F. It has specific gravity of 0.95, and is oxidized by nitric acid to acetic and succinic acids. It is also known as “caproic acid,” and its salts are sometimes called caproates, and sometimes hexoates.

HEYSE, hī'zė, **Paul,** German poet and novelist: b. Berlin, 15 March 1830; d. April 1914. He studied classics in his native city, in 1852 traveled in Switzerland and Italy, and two years later he settled in Munich on the invitation of King Maximilian II of Bavaria, who granted him a pension. He lived mainly in Munich, devoted almost exclusively to literature. He was ennobled in 1910 and was awarded the Nobel prize for literature in 1911. His first work was ‘Jungbrunnen, Märchen eines fahrenden Schülers’ (Tales of a Traveling Scholar) (1850); and to the same year belongs his tragedy ‘Francesca da Rimini.’ ‘Die Brüder’ (1852) and ‘Urica’ (1852), were narrative poems, and formed part of the volume entitled ‘Hermen’ (1854), later ‘Novellen in Versen,’ which did much to establish his reputation. Heyse's genius found its most perfect expression in his tales or novelettes (Novellen), and in this department of literature he holds almost a unique place among German writers. His work is almost throughout highly finished and artistic, and shows a rich imagination and great fertility in invention. His tales have been published in more than 20 collections, and a selection appeared in 1890 under the title ‘Auswahl fürs Haus.’ His early successes in narrative verse were followed by such works as ‘Die Braut von Cyperin’ (1856); ‘Thekla’ (1858); ‘Rafael’ (1863); ‘Syritha’ (1867); ‘Der Salamander’ (1879); ‘Die Madonna im Olwald’ (1879); ‘Liebeszauber’ (1889). His best plays are those of his third period, and some of them, especially ‘Hans Lange’ and ‘Kolberg,’ have been acted with great success. ‘Mary of Magdala’ was well received in America. Among them are ‘Die Hochzeit auf dem Aventin’ (1886); ‘Gott schütze mich vor meinen Freunden’ (1888); ‘Hans Lange’ (1866); ‘Kolberg’ (1868); ‘Die Weisheit Salomos’ (1887); ‘Weltuntergang’ (1889); ‘Die schlimmen Brüder’ (1891); ‘Wahrheit?’ (1892); and ‘Jungfer Justine’ (1893). His larger novels, ‘Kinder der Welt’ (1873); ‘Im Paradiese’ (1875); ‘Merlin’ (1892); and ‘Über allen Gipfeln’ (1895), have met with great success. Among other works are ‘Skizzenbuch’ (1877); ‘Verse aus Italien’ (1880); ‘Spruchbüchlein’ (1885); ‘Gedichte’ (Poems, 5th ed., 1895); and ‘Neue Gedichte und Jugendlieder’ (1897). Consult Biese, A. H., ‘Deutsche Literaturgeschichte’ (Munich 1913); Brandes, Georg, ‘Moderne Geister’ (Frankfort 1887); Kraus, Otto, ‘Paul Heyses Novellen und Romane’ (ib. 1888); Kummer, F., ‘Deutsche Literaturgeschichte des 19. Jahrhunderts’ (Dresden 1909); Petzet, E., ‘Paul Heyse als Lyriker’ (ib. 1913). See CHILDREN OF THE WORLD.

HEYWARD, hā'ward, **Thomas, Jr.,** American patriot: b. Saint Luke's Parish, S. C., 1746; d. there, 6 March 1809. He was of much prominence in North Carolina during the Revolution, was a delegate to the Continental Congress 1775–78 and one of the signers of the Declaration of Independence. In later years he was a judge in his native State.

HEYWOOD, John, English dramatist of the first half of the 16th century. He was a paid musician at the court of Henry VIII, with whom he became a favorite on account of his skill in music. Heywood's dramatic works may be classed as interludes, standing between the miracle-plays and the drama proper. The earliest of them, ‘A Merry Play between the Pardoner and the Frere, the Curate and Neybour Pratte,’ was written before 1521. Another famous piece is ‘The Four P's, an interlude in which figure a Palmer, a Pardoner, a Potycary, and a Pedlar.’ His allegory of the ‘Spider and the Fly’ (1556) fully reveals Heywood's religious proclivities. By spiders, the Protestants are meant; by flies, the Catholics.

HEYWOOD, Thomas, English dramatist: b. Lincolnshire; d. c. 1650. He studied at Cambridge and appears to have been writing plays as early as 1596. Of all the old dramatists he was the most prolific. We learn from the preface to ‘The English Traveller’ that down to 1633 he had “had either an entire hand, or at the least a main finger,” in the composition of 220 plays; and he continued for some years after that date to write for the stage. Twenty-four of Heywood's plays have been preserved. The best is ‘A Woman kilde with Kindnesse’ (1607). His work is usually distinguished by naturalness and simplicity; but he wrote at the beginning of his career one absurdly grandiose play, ‘The Foure Prentises of London’ (1615), which was parodied by Beaumont in ‘The Knight of the Burning Pestle.’ ‘The Rape of Lucrece’ (1608) is chiefly noticeable for its songs; ‘Love's Maistresse’ (1636), dealing with the story of Cupid and Psyche, is fanciful and ingenious; and there is much tenderness in ‘A Challenge for Beautie’ (1636). ‘The Captives, or the Lost Recovered,’ an interesting play, acted in 1624, was first published in 1885.

HEZEKIAH, hĕz-e-kī'a (*Hizkiyah*, generally *Hizkiyahu*, strength of Jehovah), the 12th king of Judah. At 25 he succeeded Ahaz about 726 B.C. to 698 B.C. He had no sooner mounted the throne than he initiated a system of reform, on the injunctions of Isaiah, and broke up the idolatrous customs into which the people had fallen during the life of his father. He also endeavored to repair the injury done by national defeats and losses. He purged, repaired and reopened the temple with magnificent sacrifices and a splendid ceremonial. So extreme was his indignation against idolatry that he destroyed the brazen serpent which was said to be the one used by Moses in his miraculous healing of the Israelites. With patriotic zeal he assumed the aggressive against the Philistines, and not only rewon the cities lost by his father, but dispossessed them of most of their own. In the 14th year of Hezekiah's reign he had a dangerous illness, which threatened serious complications, and the kingdom was in a difficult crisis, for the king had no heir, Manasseh not being born till long afterward. The greater part of the Scripture records bearing on the reign of Hezekiah is occupied by the two invasions of Sennacherib. Several of the Psalms are supposed to allude to the discomfiture of Sennacherib, for example, xlvi–xlviii, lxxvi. Hezekiah did not long survive this deliverance, dying after a reign of nearly 29 years. Among the many highly useful works executed by him, the aqueducts of Jerusalem are of especial importance.

HIAWATHA, hī-a-wâ'ta or -tha, the hero of an American Indian legend known by this name among the Iroquois and among the other tribes. He is mentioned in various works on the aborigines, and in 1855 was immortalized in the poem, ‘Hiawatha,’ by Longfellow.

HIAWATHA, Kan., city, county-seat of Brown County, on the Saint Joseph and Grand Island and the Missouri Pacific railroads, about 70 miles northwest of Kansas City and 55 miles north of Topeka. It is situated in a rich agricultural region and has grain elevators, foundries and a flour mill. Its chief manufactures are flour, foundry products and agricultural implements. Its trade is principally in wheat, corn, fruit, livestock, flour and lumber. It has the Morrill Public Library and an academy in a Carnegie library building. The city owns and operates the waterworks and an electric-light plant. Another electric-light plant is owned by a private corporation. The commission form of government was adopted in 1914. Pop. 2,974.

HIBBARD, Freeborn Garretson, American clergyman: b. New Rochelle, N. Y., 22 Feb. 1811; d. 1895. He was the son of the Rev. Billy Hibbard, a clergyman of the Methodist Episcopal Church, well known for his eccentricity and his revivalist preaching. At the age of 18 the son entered the ministry and held various pastorates in New York State until 1856, when he became editor of the *Northern Christian Advocate*. Four years later he was chosen presiding elder of the Geneva district. His principal writings are ‘Christian Baptism, its Subjects, and its Import, Mode, Efficacy and Relative Order’ (New York 1845); ‘Geography and History of Palestine’ (1851); ‘The Psalms, Chronologically Arranged’ (1856); ‘The Religion of Childhood, or Children in their Relation to Native Depravity, to the Atonement, to the Family, and to the Church’ (1864); ‘Commentary on the Psalm’ (1882); the Whedon series of ‘Commentaries on the Old Testament’; ‘History of the late East Genesee Conference’ (1887), and edited ‘Sermons’ (1869) and ‘Works’ (1872).

HIBBARD, George, American writer of short stories: b. Buffalo, N. Y., 1858. He was graduated at Harvard in 1880 and was admitted to the bar in 1886. He at one time devoted much time to painting and exhibited at the National Academy of Design in 1887. He has also illustrated his own stories. He has written ‘Iduna, and Other Stories’ (1891); ‘Nowadays’ (1893); ‘The Governor’ (1892), etc. His work is marked by finished style and much insight into character.

HIBBEN, John Grier, American university president: b. Peoria, Ill., 19 April 1861. He was graduated at Princeton in 1882. He also studied at Princeton Theological Seminary and at the University of Berlin. He was ordained to the Presbyterian ministry in 1887 and was thereafter pastor at Chambersburg, Pa., until 1891. He then took up the teaching of logic at Princeton, where he was professor from 1897 until 1912. In the latter year he was chosen president of the university. He has published ‘Inductive Logic’ (1896); ‘The Problems of Philosophy’ (1898); ‘Hegel's Logic’ (1902); ‘Deductive Logic’ (1905); ‘The Philosophy of the Enlightenment’ (1909); ‘A Defence of Prejudice, and other Essays’ (1911); ‘The Higher Patriotism’ (1915), and edited ‘Epochs of Philosophy’ by authors in the United States and Great Britain (12 vols., 1905).

HIBERNATION, the winter sleep of warm-blooded animals. Under this term is also included the torpidity of frogs, toads, reptiles, certain fishes, insects, the horseshoe crab and snails, which is mainly due to prolonged cold. Among the mammals which hibernate are the bear, dormouse, badger, bat and hamster; a number are incomplete hibernators, as the prairie dog, while squirrels fall into a winter sleep during the coldest weather, but may be seen in warm spells in winter. The males of the black and white bear are more or less active during the winter months, while the females are hibernating. The bears and some others, like the skunk, may in the southern portion of their range not hibernate at all. Neither do the hibernators all retire to their holes or dens or under fallen trees at the same date, but the time varies with the temperature, and different degrees of torpidity are exhibited. It also appears that continuous hibernators do not lay in a supply of food, as do intermittent ones like squirrels; yet the Arctic fox is said to store up a supply of dead lemmings, ermines, geese, etc.

Hibernation is like sleep and has been compared with trance. During this period the animal functions are nearly suspended, the excretions are greatly diminished and in the bears the rectum is closed by a resinous plug, called by the Swedes «tappen» and by American hunters «seal.» The animal heat is lowered to that or nearly that of the air, the action of the heart being slight; there is an increased muscular irritability and the animal loses from 30 to 40 per cent of weight.

Snakes, lizards, frogs, salamanders and certain fishes hibernate, burying themselves in the earth below the reach of frost, the aquatic forms digging into the mud at the bottom of streams. The few fishes which are known to lie dormant and take no food sink into the mud of streams or of the sea. The horseshoe crab burrows in the mud beyond the reach of oyster dredges in November, remaining in deep water until the middle of spring. Most insects hibernate in the larva or pupa state, a few when adult, as certain moths, butterflies and beetles. Caterpillars hide under moss, the bark of trees, etc., but they freeze solid and may be broken into two pieces like an icicle; they gradually thaw out in spring, but when the changes are sudden, great numbers die. Spiders and snails hibernate under stones, moss, etc., while slugs bury themselves in the mud, and mussels and other mollusks living in streams and lakes descend into the mud.

Estivation.— In the tropics there is a corresponding period of torpor during the hot, dry season, when food is scarce and vegetation is taking a rest. Alligators, snakes, certain mammals, as the taurec, insects and land-snails become dormant, the last-named closing the mouth of their shells with a membrane-like substance (epiphragm), leaving a small opening in it for the admission of air in breathing, yet after a prolonged shower they become active. Thus it is seen that heat, dryness and the lack of food operate in causing estivation, while cold and famine appear to be the cause of hibernation; though all species are by no means affected alike. Among the lowest organisms the dormant vitality of resting spores, seeds of plants, winter eggs of sponges, of polyzoa, and the dormancy of certain adult forms, are connected with a lowered temperature, and a resting period is necessary both in plants and animals. The simultaneous shedding of the leaves of deciduous trees is certainly connected with if not caused by cold, and it is undoubtedly true that changes of temperature as well as lack of food, and the need of rest, cause hibernation and summer dormancy.

HIBERNIA, the ancient name applied to Ireland (q.v.).

HIBERNIANS, The Ancient Order of. This order traces its origin to those ancient orders into which the people of Ireland were divided for many centuries before the coming of Saint Patrick.

The Military Orders.— The first of the orders was the military order of the Golden Collar, instituted by Munemen, king of all Ireland about 900 B.C. The custom of dividing society into orders seems to have been a Milesian innovation, as the Milesian kings instituted in succeeding centuries the bardic order, to sing the songs of war and peace; the order of druids, to offer sacrifices and perform all priestly offices; the order of brehens, to arrange and administer the laws and the ellamhs, to preserve genealogies and the history of the people. The military orders made the most legible impression on the history of ancient Ireland of any of the divisions of the inhabitants. It was the military orders which were marshalled for the defense of the island when menaced by the Romans. In all foreign wars they provided the soldiers who crossed the Irish sea to fight the Picts, the sea-roving Danes or the Saxons, or even the Celtic inhabitants of ancient Britain.

It was these military orders which accompanied Daithi, king of all Ireland, in his invasion of Gaul in 420 A.D., when he led the van of the immense multitude of warriors of all the northern nations which drove back the Roman power beyond the Alps. Niall of the Nine Hostages led the military orders in the forays to Britain and Gaul which are so well authenticated because it was on one of them that he brought back the boy Patrick, who afterward Christianized the country. While the Order of the Golden Collar was undoubtedly the first of the national military orders, yet the provincial orders of Munster, Connaught, Ulster and Leinster achieved immense celebrity because of their warlike deeds. The fame of these provincial orders was recounted in poems and songs by bards and ollamh's, and many of the loftiest sentiments ever uttered occur in the recitals of Ossian when recounting the martial prowess of the heroes of these orders. The duels of Finn MacCool and Loda are told in an imagery equal to that of Homer in the immortal narration of Achilles and the siege of Troy. Other old manuscripts tell of Queen Maeve, who led the Knights of Connaught, the Clanna Morna; of the Knights of the Red Branch of Ulster, of the Clanna Deagha of Munster, and of the Feni of Leinster. These orders had rules and vows, and the claim has been made that in Ireland will be found the first trace of standing armies and of the institution of chivalry.

Influence in Irish History.— When the people became Christian the military orders seemed to have lost somewhat the old influence. But with the revival of the foreign wars and the first incursions of the Danes, the ancient orders once more took the leadership in society. In the 6th century the knightly orders were consecrated to the service of the Church, receiving the cross as their badge as the defenders of religion. This fact is chronicled in Ashmead's 'Ecclesiastical History of the Irish Church.' Yet even the christianizing of the island did not weaken the strength of the traditions which had raised the old champions of the Knights of the Red Branch, the Feni, the Knights of Munster and Connaught with almost the attributes of deities. The characteristic of all primitive peoples is to worship mighty men, and the feats of Loda, Finn MacCool, Fergus MacRoy, and the other leaders were told through the generations, and even to this day are the basis of many of the habits of the Irish people.

The written rules of the ancient orders are believed to have antedated any system of organized military knighthood among mankind. These rules required that the candidate should be of good moral character, in perfect physical health, of an uncorrupted lineage and be able to pass a severe test of body and mind. He entered one of the military schools of the knights, where his education was directed for three years by the most learned teachers of literature and by the most celebrated masters of arms. The Abbe MacGeehegan, Mooney and other historians quote these rules from the original Gælic manuscripts as evidence of the remarkable attention given to the art of war in pagan

Ireland. It is recorded in numerous tales, songs and genealogies that almost all the kings, bards, sages and statesmen were on the rolls of the ancient orders of knighthood. In the long list it is noticeable that certain families maintained an hereditary leadership in their respective orders. This peculiar fact is not unnatural among a people whose regard for genealogy surpassed that of other nations. Among these families no line of descent is more renowned, nor marked with more legible clearness, than the family of Roderick the Great, which originated with the great champions Conall Kearnach and Lugadh (Loda), whose mighty swords were in the fables and mythology of the pagan Irish analogous to the hammer of Thor and the fury of Ægir among the Norse peoples. These warriors were the founders of the O'Moore family, who were regarded by the Irish people as the hereditary marshals of the ancient orders even after the coming of the Normans. It is upon the traditions which connect this celebrated family with the ancient orders that the descent of the present Ancient Order of Hibernians from the mists of the pre-Christian past through the Middle Ages to modern times is so distinctly defined. Again and again this family appears in history, and almost invariably they are accompanied by a military band easily indentified as the successors of the ancient orders. Thus at the siege of Dublin in the 12th century by Roderick O'Connor, the last native king of all Ireland, there was a large body of the Knights of Connaught, degenerate, perhaps, in soldierly skill, but still preserving some trace of individuality. In the 13th, 14th and 15th centuries the Knights of the Red Branch appear in old chronicles, and in the wars against the English during the reign of Queen Elizabeth Rory Oge O'Moore, and his son Owen, carried on the martial fame of their ancestors, the captains of the ancient orders.

In the 17th century the ancient orders were endowed with a national character through their revival and reorganization in the Catholic Confederation of Kilkenny by the popular hero, Rory O'Moore, a nephew of Rory Oge. This Confederation, which attempted to establish the independence of Ireland, conducted a national war against the English for 10 years. Its armies, under Owen Roe O'Neil, Bishop Heber MacMahon and Preston, took the vow of the Confederation, which was substantially the same as the vow of the ancient orders and almost identical with the obligation of the Ancient Order of Hibernians to-day. A nephew of Rory O'Moore, Sir Patrick Sarsfield, was the chief figure in the war against the English under William of Orange, and the Rapparrees, an irregular organization of scouts and light cavalry, carried on a desultory warfare until the early years of the 18th century. The Rapparrees had signs, passwords and a somewhat loose system of organization which was adopted by their successors, the Whiteboys of the South, who endeavored to redress many grievances regarding land tenure through both civil and forcible means until they were succeeded by the various agrarian societies which expressed the protest of the peasants against intolerable conditions all through the latter part of the 18th and the early part of the 19th centuries. In the North in the latter part of the 18th century the Defenders were organized to resist the encroachments of the Orangemen, with whom skirmishes and battles were frequent. During the Revolution of 1798 the Defenders aided the Irish patriots, and in the United Irish movement they loyally supported Wolfe Tone and the gifted band of young men who sought to establish an Irish Republic.

History in America.— The Defenders and the Whiteboys had a system of intercourse and identification during the troubled times from 1790 to about 1820, and this connection resulted in the Ribbon Confederation, which was both Catholic and agrarian. When the Ribbonmen were legally suppressed and the emigration to England assumed considerable proportions, some Irishmen in Liverpool, to avoid the suspicion of the authorities and for the purpose of aiding their fellow-countrymen, formed the Saint Patrick's Funeral Benefit Society. The name was changed several times, and Saint Patrick's Fraternal Society, Saint Patrick's Friendly Association, etc., are stated to have been the appellations. Branches of the Saint Patrick's Funeral Benefit Society were established in the large industrial cities of England and Scotland, and in 1836 the society crossed the Atlantic. In May of that year a written charter was received in New York city. The organization was established simultaneously in New York city and in the anthracite coal regions of Pennsylvania, where the emigration of Irishmen had been large from the coal-mining counties of England. The headquarters was for a few years in Schuylkill County, Pennsylvania, but greater convenience in transacting both domestic and foreign business resulted in their removal to New York city. In 1851 a charter was granted to the New York Divisions under the name of "The Ancient Order of Hibernians in America." National conventions were held in New York city until 1878 annually, and all the national officers were chosen from New York and vicinity. Since that year national conventions have been held in many other cities, and since 1884 have been held biennially. In 1876 there were bitter labor disturbances in the anthracite coal regions, and in these strikes and feuds a secret organization called the "Molly Maguires" was given an unenviable notoriety through assaults committed by its members upon mine bosses. While the spirit of the ancient order and its precursors has ever been animated with the fraternalism of the trade union, yet the attempt to cast odium upon the ancient order because of the violence of the "Molly Maguires" was peculiarly unjust, as the members of this secret organization were, except in a very few cases, not connected with the Ancient Order of Hibernians. The national convention of the ancient order in 1877 denounced the "Molly Maguires" and disclaimed any sympathy with lawlessness on any pretext.

During all its history in America the Ancient Order of Hibernians accorded most valuable support to every Irish national movement. The Divisions of the A. O. H. were the recruiting field for the Fenian Society, for various associations which forwarded relief to the famine sufferers and to the victims of landlordism in Ireland. Michael Davitt declared that without the co-operation of the Ancient Order the Land League of America would have failed in its purpose. Almost all the famous Americans of Irish birth or blood have been members of the order, and among these were Gen. Thomas Francis Meagher, Col. Michael Doheny, Gen. Michael Corcoran and Col. John O'Mahony.

Statistics.— In 1916 the organization had divisions in 50 States and provinces. Its membership, comprising about 150,000 men and 70,000 women, includes residents of the United States, Canada, Alaska and Hawaii. It has aided multitudes of emigrants to obtain the means of livelihood, and for many years co-operated with the associations which aided Irish settlers to found homes in the West. The A. O. H. had, in 1916, assets of more than $2,500,000, and its annual payments to charitable purposes, to education and religion, exceed $2,600,000 annually. For sick and death benefits it pays annually more than $1,100,000, and during its existence in America has donated nearly $21,000,000 to works of beneficence. Among the most useful of its gifts is the $50,000 endowment of the chair of Gaelic and Irish History in the Catholic University, and its contribution of $40,000 to the Catholic Church Extension Fund and $40,000 to the San Francisco earthquake sufferers. The Ladies' Auxiliary was founded at the Omaha National Convention in 1894, and has increased until it numbered in 1916 70,000 members, inspired by devotion to home, religion and patriotism, with ideals of noble womanhood, and encouraging education, morality and social uplift with increasing vigor and efficiency. Among the gifts of the Ladies' Auxiliary is its endowment of the chair of Irish Literature in Trinity College, with $10,000.

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JOHN O'DEA,
Secretary, Ancient Order of Hibernians in America.

HIBISCUS, hi-bis-kŭs, a genus of plants of the mallow family (q.v.), distinguished by a calyx surrounded by an involucre and by a fruit of three or more many-seeded carpels united into a capsule. The species are numerous, mostly natives of warm climates, some trees or shrubs, but most of them large herbaceous plants. Many bear very beautiful flowers, much used in the South Sea Islands in wreaths, etc., for personal adornment. The rose-of-Sharon or Althaea (*Hibiscus syriacus*), a native of Syria, has long been in cultivation as an ornamental shrub. Several other species have become favorite hothouse plants. The rose-mallow (*H. moscheutos*) is among the most striking and beautiful of North American wild flowers, conspicuous among the reeds of marshes in late summer with its pink blossoms. The characteristic mucilaginous and fibrous properties of the Malvaceæ are very strongly developed in this tribe. The fruit of *H. esculentus*, called gumbo, okra, etc., is in general use for food in the East and West Indies and the United States. It is an annual plant, with a soft herbaceous stem, three to five feet high, crenate leaves, axillary sulphur-colored flowers, and pyramidal, somewhat podlike capsules. The fruit is used in an unripe state, and is generally much esteemed, but is disliked by some on account of its viscidity. It enters as an important ingredient into the pepper-pot of the West Indies, or is used in soups. It also produces a coarse fibre. The bark of *H. tiliaceus*, a tree 20 feet high, with a very thick bole, abounds in mucilage. This is one of the most abundant trees of the South Sea Islands; and the wood, being light, tough and durable, is used for many purposes. From its fibre the Tahitians manufacture matting. Many other species yield fibres, some coarse, some fine and beautiful, which are used in different countries; but the most important in this respect is *H. cannabinus*, the Deccan hemp of western India (see HEMP). *H. sabdariffa* is very generally cultivated in warm countries, on account of its calyx, which, as the fruit ripens, becomes fleshy, and acquires a very pleasant acidity. It is much used for making tarts and jelly, and a decoction of it, sweetened and fermented, affords a refreshing beverage, well known in the West Indies as sorrel cool drink, the plant being called red sorrel; and in Madras it is used for similar purposes, and is named roselle or rouselle. Musk-seed (*H. abelmoschus*) is cultivated for its seeds, which have a fragrance between that of musk and that of amber. They are much used by perfumers, and are called *graines d'ambrette*. In Egypt and Arabia they are mixed with coffee, and stimulant and stomachic qualities are ascribed to them. The petals of *H. rosa-sinensis* possess astringent properties, and they are also used by the Chinese to stain their eyebrows and their shoes black.

HICCUP, or HICCOUGH, is a spasmodic affection of the diaphragm caused sympathetically by the irritation of structures supplied by nerves communicating with the phrenic nerve. Though generally a slight and passing inconvenience, its occurrence in the last stages of acute disease is a grave symptom, indicating general collapse of the nervous system. It may last only a few minutes or may continue for weeks without being capable of being subdued by any kind of treatment. Fasting or a stimulant suddenly swallowed is one of the commonest causes of hiccup, which generally passes off of its own accord. Nothing removes it more effectually than some active emotion of the mind suddenly excited. Hiccup is a common attendant of dyspepsia, and is often observed in abdominal diseases when terminating fatally, and is especially a symptom in some forms of hernia. Many remedies have been suggested for it, such as holding the breath as long as possible, tying a belt tightly round the waist and the frequent swallowing of small rounded pieces of ice.

HICHBORN, Philip, American naval officer: b. Charlestown, Mass., 1839; d. 1 May 1910. In 1869 he entered the United States navy;

in 1875 was made constructor, and in 1881 a member of the naval advisory board. From 1893 until his retirement 4 March 1901, he was chief constructor, and as such was identified with the reorganization and enlargement of the new United States navy. He attained rear-admiral's rank, and published a valuable report on foreign dockyards.

HICHENS, Robert Smythe, English journalist and novelist: b. Speldhurst, Kent, 14 Nov. 1864. He was educated at Clifton College and the Royal College of Music, and after a short career as a musician turned to journalism. In 1893 he visited Egypt for his health, and there conceived the idea which materialized in the 'Imaginative Man' (1895); 'The Green Carnation' (1894), however, epigrammatic and keenly satirical in tone, first brought him into public notice. Later works of his are 'After To-Morrow' (1895); 'New Love' (1895); 'The Folly of Eustace and Other Stories' (1896); 'The Londoners' (1897); 'Byeways' (1897); 'The Prophet of Berkeley Square' (1901); 'The Woman with the Fan' (1904); 'The Garden of Allah' (1905); 'The Call of the Blood' (1906); 'Bella Donna' (1909) and successfully dramatized; 'Barbary Sheep' (1909); 'The Dwellers on the Threshold' (1911); 'The Way of Ambition' (1913); 'The Near East' (1913); 'In the Wilderness' (1917).

HICKEY PLOT (1776), a conspiracy of the British officials and Loyalists of New York to end the Revolutionary War by the murder or capture of its leaders and the seizure or destruction of its supplies. The heads and probable devisers of it were Governor Tryon, who had fled from the city but remained on a man-of-war in the harbor, and sent supplies of money for bribery, etc.; and Mayor Mathews. The scheme was to kill or seize the patriot generals, and at all events to deliver Washington alive to Sir William Howe, blow up the magazine and secure the passes to the city. Several hundred New York Loyalists were involved. Two of Washington's guard were bought, but a third pretended to accede and revealed the plot. Mathews, a goldsmith named Forbes and a dozen others were arrested and sent to Connecticut, Mathews carrying the mayoralty flag with him. Thomas Hickey, one of the treacherous guards, was hanged in New York, 27 June 1776, the first military execution in the American army.

HICKOK, Laurens Perseus, American metaphysician: b. Danbury, Conn., 29 Dec. 1798; d. Amherst, Mass., 6 May 1888. He was graduated at Union College in 1820, was licensed as a preacher in 1822 and was pastor successively at Newton and Litchfield, Conn., till in 1836 he was elected professor of theology in the Western Reserve College, Ohio, where he remained eight years. He was professor in the Auburn Theological Seminary 1844–52, and then became professor of mental and moral science, and vice-president in Union College. In 1866 he was formally made president of that institution of which, however, he had been in sole charge for eight years previous. His publications include among other works 'Rational Psychology' (1848); 'Moral Science' (1853); 'Empirical Psychology, or the Human Mind as Given in Consciousness' (1854); 'Rational Cosmology' (New York 1858), in which he attempts to demonstrate a priori the laws of the universe; 'Creator and Creation' (1872); 'Humanity Immortal' (1872); 'Logic of Reason' (1875).

HICKORY (formerly HICKORY TAVERN), N. C., town in Catawba County, on the Southern and the Carolina and Northwestern railways, near the headwaters of the Catawba River, about 43 miles northwest of Charlotte and 50 miles west of Salisbury. The chief manufactures are flour, foundry products, wagons, lumber, air pumps, hosiery, gloves, carriages, overalls, harness, leather, boots and shoes. It has several private educational institutions: Claremont Female College, opened in 1880; Saint Paul's Lutheran Seminary; Lenoir College, opened in 1891, under the auspices of the Lutheran Church. The commission form of government was adopted in 1913. Pop. 3,716.

HICKORY, a group of trees of the walnut, forming the genus *Hicoria*, and exclusively North American. They are large strong trees, 60 to 80 feet high, with close shaggy bark and large pinnately divided leaves, pistillate flowers on a terminal peduncle and staminate flowers in long, drooping aments. The fruit is a thick-shelled nut in a tough green husk. There are about 10 species, all natives of the eastern United States and Canada except a Mexican species. The best known of these are the following: Shag-bark, shell-bark or white hickory (*H. ovata*), leaflets 5 to 7, whose bark scales off in great plates curving outward at both ends, and whose nuts are sweeter and better than those of any other species; the northerly "big shag-bark" or king-nut (*H. laciniosa*), leaflets 7 to 9, with narrower "shags," darker wood and big nuts in husks often three inches long; white-heart, or fragrant hickory, or mocker-nut (*H. alba*), noted for the hardness and toughness of its wood; the pignut or broom hickory (*H. glabra*), leaflets 3 to 7, which represents a group of moisture-loving species whose nuts are thin-husked, elongated and bitter and astringent to the taste.

Uses of Hickory-wood.— As timber this wood is of great value for articles requiring great strength with lightness and elasticity; but it is liable to quick decay when exposed to the atmosphere, and for this reason is little used in buildings, and should be painted. It was the most serviceable of all woods to the aboriginal Americans; and the axe, pick and tool handles made from it are exported to all parts of the world. It enters into the manufacture of rakes, cradles and many forms of farm-implements; is largely used in carriage-making, especially for thills, shafts and the parts of racing-sulkies, the lighter American vehicles owing their acknowledged pre-eminence largely to the availability of this wood. The wood of the various species differs in quality, however; that of the pecan is hard and brittle, and the water hickory soft and comparatively light. The wood of the others is exceedingly strong and tenacious, and weighs about 50 pounds to the cubic foot.

Insect Pests.— A. S. Packard recorded in

1890 170 species of insects attacking the hickories; and Chittenden declared in 1903 that this number could be easily doubled. Hickory appears to be an especial favorite of borers. Prominent among them are the painted hickory-borer, one of the long-horned beetles (*Cyllene picta*); the hickory twig-girdler (*Oncideres cingulata*), twig-pruner (*Elaphidion villosum*), and hickory-bark beetle (*Scolytus quadrispinosus*). This bark-borer is the most important economic species, and during recent years has been the cause of considerable injury in hickory forests in the State of New York. Consult Packard, 'Insects Injurious to Forest and Shade Trees,' published in 1888 as the fifth report of the United States Entomological Commission.

HICKS, Elias, American preacher of the Society of Friends: b. Hempstead, L. I., 19 March 1748; d. Jericho, L. I., 27 Feb. 1830. While a youth he manifested a talent for public speaking, and at 27 was a well-known preacher. For many years he labored zealously in advancing the generally accepted doctrines of the Friends; but having as he believed discovered errors in these tenets, put forth views of his own which he defended with energy and ability. To advance these views he traveled extensively in the United States and in the British provinces, attracting large congregations by his oratory. The result was a schism in the body of Friends, those adhering to the old doctrines being specially termed orthodox, while the followers of Hicks were called after him Hicksites. (See FRIENDS). He was an active abolitionist and with others was instrumental in inducing the State of New York to pass an act which, on 4 July 1827, liberated all slaves within its borders. He was the author of 'Sermons' (1828); 'Observations on Slavery' (1811); 'The Letters of Elias Hicks' (1834); etc. Consult 'Elias Hicks, Journal of his Life and Labors' (1828).

HICKS, Thomas, American painter: b. Newton, Pa., 18 Oct. 1823; d. 1890. He studied at the Philadelphia Academy, at the National Academy, New York, and afterward in Paris under Couture. Settling in New York he became one of the favorite portrait painters of his day. His pictures in the rooms of the New York Historical Society form an interesting gallery of historic figures, executed with more than ordinary artistic skill.

HICKS, Thomas Holliday, American politician: b. Dorchester County, Md., 2 Sept. 1798; d. Washington, D. C., 13 Feb. 1865. After successively occupying the positions of sheriff, member of the State legislature, member of the State electoral college and member of the governor's council, he was in 1858 elected governor of the State. When war was threatened between North and South, although sympathizing with the South and condemning the North's attitude on the slavery question, he sided with the party of neutrality in Maryland and opposed the secession of that State. When there were rumors of a plot formed by 6,000 men of his State to prevent Lincoln's inauguration and seize the city of Washington he suspended the writ of habeas corpus, and planned the arrest of suspected persons. He was the only prominent State official who stood by the Federal government, and at the expiration of his term as governor the new legislature passed resolutions thanking him for having saved the State from joining the Confederates. In 1862 he was appointed to the Senate of the United States and served in it till his death.

HICKS-BEACH, SIR Michael Edward, first Viscount St. Aldwyn, English statesman: b. London 1837; d. 30 April 1916. He was educated at Eton and Oxford, entered Parliament in 1864, and was Chief Secretary for Ireland in 1874–78, 1886–87, and Secretary of State for the Colonies in 1878–80. In 1885–86 and 1895–1902 he was Chancellor of the Exchequer and leader of the Conservative party in the House of Commons. He was president of the Board of Trade from 1888 to 1892. On the fall of the Gladstone ministry in 1895 he again was Chancellor of the Exchequer 1895–1902. On Lord Salisbury's retirement from public life he also left the government. In the fiscal controversy raised by Chamberlain's tariff reform proposals he warmly defended the established free trade policy; but his loyalty to Mr. Balfour, the new Premier, was shown by his successful efforts to prevent the immediate snapping of party ties on the part of the free-trade Unionists.

HICKSON, Sydney John, English zoologist: b. London, 25 June 1859. He was educated at Cambridge and has been professor of zoology at Owens College, Manchester, England, from 1894. He has published 'A Naturalist in North Celebes' (1889); 'The Fauna of the Deep Seas' (1894); 'The Story of Life in the Seas' (1898).

HIDALGO Y COSTILLA, Miguel, mē-gĕl' ē-däl'gō ē kōs-tēl'yä, Mexican revolutionist, first leader in the Mexican war of independence: b. state of Guanajuato, 8 May 1753; shot in Chihuahua, Mexico, 27 July 1811. He was a priest, and in earlier life was simply a man of great acquirements, anxious to promote industry in Mexico, and noted for conscientious fulfilment of his ecclesiastical functions. He is said to have introduced the silkworm into Mexico, and did much to promote the culture of the vine. This conflicted with the policy of the Spanish government, which was to discourage all manufactures or agriculture which could interfere with the revenue, and the vines Hidalgo had planted were destroyed. This drove him to rebellion. Possessing much influence among the Indians, he formed the plan of a general insurrection, which was to take place 1 Nov. 1810; but the plot having been disclosed by one of the conspirators, some of his party were arrested, and he was obliged to precipitate his movements. On 10 September having been joined by three officers of the garrison of Guanajuato, he raised the standard of revolt. His eloquence had a remarkable effect on the multitude who heard him, and when after his oration he unfurled a rude copy of the picture of Our Lady of Guadalupe, the patroness of Mexico, the war assumed the character of a crusade. On 29 September with an army of 20,000 men, mostly Indians, he captured Guanajuato. He took Valladolid and several small places, and soon after was proclaimed generalissimo of the Mexican army, and advanced against Mexico; but finding himself almost without ammunition, was obliged to retreat. During this war the government party declared that the ordinary rules of warfare need not be observed as regarded the insurgents, while the latter retaliated with the most horrible atrocities. On one occasion Hidalgo is said to have massacred 700 prisoners because they were Europeans. After several defeats the insurgents were left at Saltillo under charge of Rayon, while Hidalgo and others went to the United States to obtain arms and military aid. On their way they were captured by a former friend, and finally shot in Chihuahua. He was after his death regarded as a saint by the people, and within a few years the place of his execution was shown to travelers as a holy spot. The town of Goliad, Tex., was named in his honor, the H, as silent in pronunciation, being omitted and the other letters rearranged. At the founding of the town the name of Hidalgo was still proscribed by the Spanish rulers and the transposition of the letters of his name was made in order to avert the attention of the authorities.

HIDDENITE, a yellowish-green or emerald-green, transparent variety of spodumene, discovered by W. E. Hidden, in 1880, in Alexander County, N. C. The emerald-green varieties have been used as gems. They resemble the emerald, but show a greater wealth of color on account of their pleochroism.

HIDES AND LEATHER. See LEATHER; TANNING.

HIERAPOLIS, hī-ėr-ŏp'ō-lĭz, Phrygia, an ancient city on the Churuk Su, about six miles north of Laodicea. Situated on a high elevation, it was noted chiefly as a religious centre. Here were sulphur springs and a deep cavity called the Plutonium or Charonium, which exuded a vapor considered poisonous to laity. Hierapolis was the seat of the mysteries of the Phrygian goddess Leto, the native goddess of nature, corresponding to Cybele. It is also renowned as the birthplace of Epictetus. Excavations on the site have uncovered ruins of tombs, a theatre, houses and a remarkable bath. Consult Ainsworth, W. F., 'Personal Narrative of the Euphrates Expedition' (1888).

HIERAPOLIS, Syria, an ancient town, also known as Bambyce (Gk.) and Mabog (Syrian), situated about 15 miles southwest of the point where the Sajur and the Euphrates meet. It first becomes known as an important station during the time of the Seleucids, and as a seat of the worship of Atargatis (q.v.), described by Lucian in his 'De Dea Syria.' A gorgeously decorated temple housed the shrine. Crassus carried off its treasures in 53 B.C., but under Diocletian it was restored and became the capital of the province of Commagene or Euphratensis. It lost prestige under Justinian, was long a centre of the struggle among the Arabs, Turks and Byzantines and was many times fought for by the Crusaders. It fell into the hands of Saladin in the 12th century, and under the Mongols fell into complete ruin. Arab walls and ruins of the old temple still survive. The Greek name Bambyce has been preserved in connection with a dress goods manufactured there through the Roman *Bombycina vestis,* in English «Bombazine.» Consult Ramsay, W. M., 'Cities and Bishoprics of Phrygia' (Vol. I, 1895).

HIERARCHY, hī'ĕ-rär-kĭ (From Gr. *hieros,* sacred, and *arche,* government), sacred government or «the administration of sacred things,» first used by the pseudo-Dionysius in the 5th century in his work on the Celestial and Ecclesiastical Hierarchies. It is now generally used to signify the body of officials in the Church organically graduated in their ranks and orders from the supreme head to those in the most subordinate position. In the Roman Catholic Church a threefold distinction is recognized: (1) A hierarchy of divine right, which embraces, under the primacy of the popes, bishops, priests and deacons. This hierarchy is held by the Church to be of divine institution. (2) A hierarchy by ecclesiastical right, consisting of the Roman pontiff and the three original divine orders and of the five minor orders (two in the East), subdeacons, acolytes, exorcists, lectors and porters (ostiarii). (3) A hierarchy of jurisdiction, which includes all the judicial and administrative authorities, ordinary and delegated, charged with the maintenance of the faith among Christians, its union, its discipline and its general care and supervision. All its powers proceed from the Pope as primate, either expressly or by implication. In this category are ranked cardinals, patriarchs, exarchs, metropolitans and archbishops, and as deriving their powers from these, archpriests, archdeacons, rural-deans, vicars-general, etc. The Anglican Church also recognizes a hierarchical rank in its body, comprising bishops, priests and deacons. The other Protestant bodies practically reject hierarchical government.

HIERO I, hī'ĕ-rō, king of Syracuse in Sicily: d. Catania 467 B.C. He was brother and successor of Gelon. Hiero's reign, though less glorious than the preceding, was marked by a peculiar splendor on account of his generous encouragement of learning. Though some blemishes tarnish the first years of Hiero's reign, he compensated for his first faults by the noble actions which signalized the remainder of his life. A long sickness was the main cause of this alteration. Since he could no longer occupy himself with the cares of royalty, he collected around him a society of learned men, and thus becoming acquainted with the pleasures of learning, he never afterward ceased to value it. His court became the rendezvous of the most distinguished men of his time. The names of Simonides and Pindar appear among those of his most constant companions, and when Æschylus left Greece, he betook himself to Hiero, to close his days in his kingdom. He was several times victor in the Grecian games.

HIERO II, king of Syracuse: b. before 306 B.C.; d. 216 B.C. He was the son of Hierocles, a noble Syracusan, who claimed a descent from the family of Gelon. During Hiero's reign began the First Punic War, and he was able, by his adroitness, to preserve the friendship of both Romans and Carthaginians. The glory of Hiero and the prosperity of Syracuse culminated in the period which intervened between the First Punic War and the second; for in that season of peace Hiero enacted wise laws and was devoted to the happiness of his subjects. His encouragement of agricultural pursuits enriched him and doubled the revenues of the state. He left the crown to his grandson Hieronymus.

HIEROGLYPHICS. Hieroglyphics («sacred carvings») is the term which the Greeks applied to the monumental writing of the ancient Egyptians. It fairly interprets the Egyptian *mdw-ntr,* «speech of the god,» though with a different connotation; for to the Egyptian of about 3500 B.C., the date of the earliest surviving hieroglyphs, *written* speech presumably was so marvelous that it seemed necessarily of divine origin, while the Greek who compounded our term 3,000 years later was distinguishing rather between the form of writing which he saw carved on tomb and temple walls and the forms then in use for pen-and-ink documents. The temple inscriptions of that later age were, as we shall see, an artificial product, a sealed book not only to the Greek but to his Egyptian contemporary; and this thought of mystery survives in our common use of the word «hieroglyphs» for any (to us) unintelligible signs. In the field of science the term has been extended beyond the Egyptian which we shall consider here to other systems of picture-writing such as the Hittite in ancient Asia Minor and the Mayan of Yucatan.

Nature.— Marks of ownership, messages, memoranda of taxes, accounts and notable personal achievements — all these call for a means of record. So identification marks are scratched on pottery jars, and royal votive offerings of carved stone commemorate their donor's conquests. For such purposes the Egyptian drew upon his environment. Men and women in various expressive attitudes, parts of the body, creatures of the animal world, objects of earth and sky, clothing, tools and weapons are among the fundamentals which could be directly illustrated. In Fig. 1 (from a votive slate palette of 3400 B.C. or earlier) the king, represented by his symbol the falcon, holds in one claw a rope passed through the nose of a human head. The latter grows out of the long, narrow sign which to the native of the long, narrow Nile Valley represented «land.» From the «land»-sign sprout six lotus leaves, such as occurred by thousands in the Delta marshes. The composite, thus resolved, indicates that the king has carried off from a hostile land 6,000 human captives. Such symbolism is, of course, not true writing; it is merely the expression of an *idea,* which different readers might phrase differently. But below the «land»-sign appears a harpoon, followed by a rectangle crossed with wavy lines. The name of the foreign land, then, is similar to the Egyptian name of this harpoon, *wa* (really *w*‘; see below); and the framed «water»-lines indicate that it is a lake region. The use of a picture of one object to stand for another concept of similar sound, as the harpoon here represents this geographic name, means that the picture in question has become so associated with one particular word expressive of its idea, that the sound of that word has finally attached itself to the picture. The latter thus acquires *phonetic* value. The taking of this step made it possible to write *abstract* terms as well as the concrete ones which alone could be directly pictured. Word-signs in transferred as well as original meanings resulted, and some pictures attained a wider phonetic usefulness as elements in the writing of longer words. The final step soon followed: illustrations of certain objects whose names contained only one prominent consonant came to stand regularly for single letters, forming the world's earliest alphabet. In contrast with the phonetic signs (word-, consonant group and alphabetic) as a whole are the signs which are not to be read but serve simply as guides to the sense. Of these so-called ***determinatives*** the «lake» above may be an example.

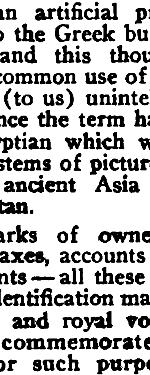


FIG. 1.

When we recall the strangeness of Chaucer to modern ears and how we treat Anglo-Saxon as a distinct tongue, it is but natural to assume that the hieroglyphs whose origin has just been traced really represent a whole series of successive languages. This is, in fact, true. The most important historical periods in Egypt, with their linguistic characteristics, are:

A. *Old Kingdom* (Dynasties III–VI, about 3000–2500 B.C.). Earlier labels on boxes, jars or grave markers are now followed by nobles' tomb-inscriptions displaying the same brevity of writing. From royal burials come the most important of all early records, the Pyramid Texts (see below).

B. *Middle Kingdom* (especially the XII. Dynasty, about 2000 B.C.), the classic age. Spellings reach their greatest uniformity and the types of literary composition are most diversified. The folk-speech of this period forms a distinct dialect, just as the common speech of to-day differs from the cultivated literary style.

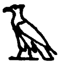
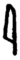
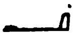
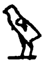
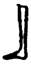
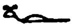
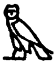
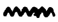
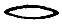
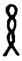
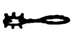
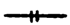
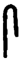
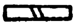
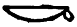
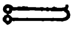
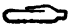
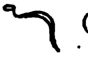
C. *Empire* (especially the XVIII–XIX. Dynasties, about 1580–1200 B.C.). Tomb and temple inscriptions in hieroglyphic are modeled on classic forms; but from these the folk-language has already diverged so widely that it deserves the distinctive name New Egyptian.

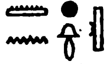
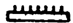
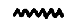
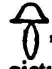
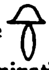
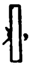
D. *Renaissance* or *Restoration* (XXVI. Dynasty, 663–525 B.C.). Imitation of Old Kingdom writing and ideas. But the hieroglyphs thus reused have passed out of current knowledge. The colloquial language of this age is named after its cursive system of writing, the demotic.

E. The *Graeco-Roman Age* (332 B.C.–4th century A.D.) used for ordinary purposes a later stage of the demotic. But its temple inscriptions were couched in absolutely artificial hieroglyphic systems which exhibit an abundance of new signs and new values.

F. The *Coptic* (3d century A.D. ff.) is the last phase of the old Egyptian tongue, transliterated from the demotic into Greek characters when Christianity was introduced into Egypt. Though now a dead language, one dialect is still in official use by the Coptic Church, paralleling Latin in the Roman Catholic.

The Egyptian linguistic principles show kinship with East and North African language-groups and likewise with the Semitic tongues of neighboring Arabia and Palestine. As in the latter, the essence of a word is contained in its *root,* the consonantal framework left after excluding prefixes or affixes, while its particular application depends on these latter or (more commonly) on only the accompanying vowel sounds. The effect is as though *ram, arm, army, ream, aroma* and *roomy* in English were all related concepts based on a root *rm*. The context is expected to suggest the proper vocalization. The resultant mental attitude reckons consonants alone as making up the alphabet. The Egyptian alphabetic hieroglyphs (as arranged by modern scientists), with their symbols and English equivalents, are:

	(carrion-kite)	ꜣ,	Hebrew א (Aleph), the smooth breathing in Greek; it may be heard in «I am» or «an hour» if the words are distinctly separated in pronunciation.
	(palm-leaf)	*y* or ỉ;	initially often = Aleph, hence the two elements of the second symbol.
	(fore-arm, palm up)	ʿ,	Hebrew ע (Ayin), a vigorous expulsion of the breath through the contracted glottis.
	(plover)	*w*	
	(lower leg and foot)	*b*	
	(mat for offerings)	*p*	
	(snail?)	*f*	
	(owl)	*m*	
	(wave of water)	*n*	
	(mouth)	*r* and *l*	
	(ground-plan of some building)	*h*	
	(twisted fibers)	*ḥ*,	fricative, stronger than *h*
	(placenta)	*h̯*,	the guttural heard in German *ach* or Scotch *loch*
	(teats, etc. of some animal)	*ẖ*,	a stronger guttural than *h̯*
	(bolt of a door)	*s*	both pronounced as *s*; what the original distinction in sound may have been is unknown.
	(folded roll of cloth)	*ś*	
	(pool of water surrounded by coping)	*š*,	the *sh*-sound
	(hill-side)	*ḳ* or *q*	
	(cup with handle)	*k*	
	(jar-stand)	*g*	
	(loaf of bread)	*t*	
	(tether)	*ṯ*.	the *th*-sound as in *thin;* later confused with *t*.
	(hand)	*d*,	really a more emphatic *t*, the Hebrew ט (Teth); the Egyptian seems to have had no real *d*-sound.
	(serpent)	*ḏ*,	etymologically = Hebrew צ (Sadhe); later confused with the preceding *d*. The *ḏ*, where it has preserved its individuality, has in Coptic a *j*-sound.

The Egyptian could have written adequately with only these 24 alphabetic characters; but he was too conservative to give up his other hard-won hieroglyphs. All the varieties, phonetic and determinative, thoroughly intermingled, persisted to the end. Thus  is the classic writing of the adjective *mnh̯*, «excellent.»* The  pictures an oblong chess-board seen from above, with a group of chessmen upon it in side view, illustrating the Egyptian art principle of faithfulness to known realities rather than to a misshapen modern perspective. It is a phonetic group-sign for *mn*; the same *n* is repeated as a so-called «phonetic complement» by the alphabetic . The alphabetic is followed by , a word-sign which will originally have pictured a maul *mnh̯*, but is found regularly in our transferred meaning instead. The use of the preceding hieroglyphs, which have already stated its phonetic value, is undoubtedly a secondary development intended to facilitate the reading; otherwise the  here might be considered a «phonetic determinative,» i.e., a determinative not of the sense but of the phonetic group. Unquestioned phonetic determinatives of parts of words do, indeed, occur. The , representing a rolled papyrus document (see below) tied with a cord and sealed with a clay pellet over the knot, is the regular determinative of abstract terms. The supplementing (not supplanting) of pictorial by phonetic signs, as seen in the above example, means that instead of 24 some 600 signs were in common use. Such a system was far more com-

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*To make pronounceable these vowelless writings of Egyptian words, the modern Egyptologist often treats certain consonants as if they were vowels (ꜣ and ʿ as *a*, *y* as *i*, *w* as *u*) and then inserts short *e*'s where needed. So *mnh̯* may be called *meneh̯*.

plicated than our English spelling, and the man who had mastered it in both its monumental and its cursive forms (see below) might well be proud to call himself a scribe. His accomplishment opened for him the pathway to high office.

Use.—By the I. Dynasty (about 3400 B.C.) the Egyptian had learned to paint or incise his hieroglyphs on stone and pottery, wood and ivory, and moreover to carve them in relief (see Fig. 1). But the most representative of all Egyptian methods of writing—in common use already by the Old Kingdom—was made possible by the papyrus plant, whose tall stalks flourished in all the swamps and pools. The long strips into which sections of the stalk could be cut lengthwise were glued together side by side and crossed at right angles by another similar layer. When pressed, dried and scraped, a flexible sheet of vegetable fibre, the direct ancestor of our modern paper, was produced. On such papyrus sheets or rolls (for the sheets were usually glued together into strips of the desired length) the Egyptian scribe wrote rapidly with pen and ink as do we, his cultural descendants. But a modern split pen-point would have been ill suited to the soft, unglazed surface of his papyrus; so the Egyptian softened the end of his reed pen, probably by chewing it, until it formed a sort of tuft with which he practically painted his characters. His black ink was of soot suspended in a solution of gum and water; his palette always carried red ink also, similarly made with iron oxide, and regularly used for headings and catch-words. This custom, passing into European manuscripts, survives to-day in printed rubrics. The papyrus was ordinarily held in the unsupported left hand, except when the roll was extremely long and heavy, in which case the scribe might squat and spread it across his knees; the pen met it at a right or slightly acute angle. As the writing-surface was unrolled from the left so as to come under the pen held in the right hand, the lines and columns naturally progressed from right to left, reversing our own method. This same Egyptian technique spread into Asia soon after 1100 B.C., almost contemporary with the appearance of the Phœnician alphabet, from which the Greek, Latin and our modern Western alphabets are descended. Now the Phœnician differs from other Hither Asiatic writing, but agrees with the Egyptian, in technique, in direction of writing, in its lack of vowels and fundamentally in the very principle of alphabetic instead of syllabic signs. So it is quite probable that the letters with which this article is printed are the remote offspring of the hieroglyphs with which it deals.

That the hieroglyphs proper, especially as used on tomb or temple wall, were intended as much to decorate as to inform is evident from the calligraphic grouping of signs as far as possible into squares and from the balancing of inscriptions as well as of scenes. For this purpose the normal order of writing, in which the signs face toward the right, the beginning of the line, is often reversed in one-half of a design. Each of the two units usually then faces toward the centre, reading from there outward. The decorative motive is emphasized in addition by pictorial details common in both cutting and painting of individual signs, and by the calmness with which scribe as well as stone-cutter can overlook errors in the text which may entirely obscure its sense for modern readers and must often have done so for the ancient. Papyrus documents, on the other hand, needed only to be useful. Thanks to the unusual dryness of the Egyptian climate, vast quantities of these elsewhere perishable records have survived. They include letters, reports of court proceedings, volumes of charms for the benefit of the dead and other volumes of romance to entertain the living. In drawing on papyrus the brush-pen naturally gave to the hieroglyphs a bolder, more cursive form. The resulting *hieratic* system of writing parallels the hieroglyphic for almost 3,000 years, being related to the latter much as modern handwriting is to print. The hieratic of the Old Kingdom was in vertical lines only, like the Chinese. During the Middle Kingdom horizontal lines appear and soon completely displace the vertical. Both styles are found together in Fig. 2, a bit of our earliest historical novel, the tale of Sinuhe (see below). Of the hieratic forms, though they change from age to age, two general types are distinguishable: the uniform "book-hand" with its signs mostly standing out individually as here illustrated, and the hurried business hand of the clerk or court reporter who often links signs together by the continuous sweep of his pen. By inevitable reaction many single signs or ligatured groups which had diverged widely from their originals were ultimately adopted as new characters into the hieroglyphic, while modified and disguised forms of others totally displaced their unequivocal originals. The process in Egypt was akin to that in early Babylonia, where, however, the rendering of signs by impressed wedges (cuneiform writing) in successive modifications not only effectively obscured the whole body of original pictures but entirely did away with the parent system. By 500 B.C. a new and more compressed business hand, the demotic, which had so lost all resemblance to the original hieroglyphs that whole associated groups of characters were fused into single signs, had developed in Egypt. The hieratic thereupon gained a sanctity which had previously accrued to the no longer understood hieroglyphs. The Greek names *hieratic* ("priestly") and *demotic* ("common, popular") applied to the two cursive systems refer, of course, like the term *hieroglyphic* itself (see above), to this late situation. As the papyrus plant was useful in so many ways that it

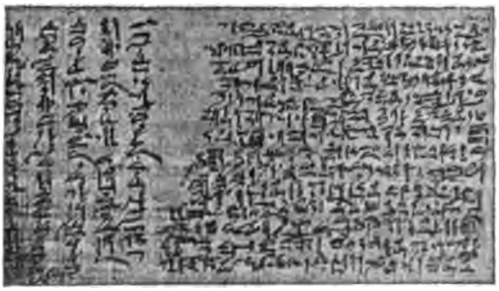


FIG. 2. Pages from the Tale of Sinuhe.

could ill be spared to make scratch paper, memoranda and even actual letters and other documents were often scribbled on potsherds or flakes of limestone, which were abundantly available to everyone. These rough substitutes, inscribed in hieratic, demotic or Coptic, are called *ostraka.*

Decipherment.— The basis of our knowledge of ancient Egyptian dates back less than 100 years. Whatever the Greeks may once have known about the subject was lost, with one unfortunate exception: the highly fanciful treatise of a certain Horapollo survived to spread a mistaken notion that the hieroglyphs were mystic symbols which pure science must avoid. Yet before 1800 the Dane Zoega had recognized that frames ("cartouches") met with around certain groups of signs indicated kings' names, and had correctly distinguished some monuments as late by their style alone. Then in 1799 Napoleon's expedition to Egypt discovered at Rosetta an inscription dated in 196 B.C., deifying King Ptolemy (V) Epiphanes for numerous benefits conferred upon the priesthood and ordering that this their resolution be displayed beside Ptolemy's statue in all the important temples "in the sacred, the demotic, and the Greek characters." The "Rosetta Stone," now in the British Museum, was evidently one of the stelae here called for; and its Greek text was expected to lead at once to decipherment of its hieroglyphic and demotic versions. The one cartouche preserved in the fragmentary hieroglyphic portion must surely contain the name "Ptolemy," which the Swede Akerblad had in 1802 identified in the demotic. The English scientist Thomas Young proceeded to assign phonetic values to the characters in this name; but study of the text as a whole failed because belief in the symbolic nature of the signs (except as used in such foreign proper names) persisted. Meantime a gifted young Frenchman, Jean François Champollion, born in 1790, had been devoting himself to Egyptian studies since the age of 12. He finally reached the correct conclusion that the hieroglyphs on the Rosetta Stone could not be word-symbols, since they were about three times as numerous as the words of the Greek translation. A few months later, in 1822, he recognized in some newly received copies of inscriptions the Empire royal names Thutmose and Ramses and realized that the signs which he had previously discovered to be phonetic in all Ptolemaic and Roman names were also phonetic in the old language. Rapid progress on the basis of his previous researches could now follow. Before his early death in 1832 Champollion had made a journey through Egypt, and his published notes on the antiquities reveal how fully he had come to understand their language. But his grasp was intuitive rather than grammatical, and much scientific skepticism persisted until his decipherment was fully confirmed by another bilingual inscription, the Decree of Canopus, found in 1866.

Among Champollion's followers should be mentioned especially the German Lepsius and his successor at Berlin, Adolf Erman, the father of Egyptian grammar. Another German, Heinrich Brugsch, composed in the years 1866–80 a seven-volume hieroglyphic-demotic dictionary, much of which, and especially the system of transliteration, is long since obsolete. For not until the work was almost completed did the wholly consonantal nature of Egyptian writing become clear. The fact that the Greeks had artificially vocalized with ꜣ, ʿ, *y*, and *w* the proper names with which decipherment began is still, indeed, used by some Egyptologists as one evidence for vowels in the Egyptian alphabet. To advance the study of vocabulary as well as grammar, the four learned academies of Germany have been engaged since 1897 in minutely classifying the words and usages of all available Egyptian texts. Specimen pages of the great 'Berlin Dictionary' which is to result were issued in 1916.

Grammar.— The classic grammatical system may be briefly outlined. Various types of roots (see above) are distinguished, according as they contain two, three (the usual number), four, or even five consonants (called *radicals*). These may be either strong or weak. The weak consonants (ꜣ, *y, w*) are so called because they combine easily with preceding vowel sounds to lengthen them or form diphthongs with them. Hence *y* and *w* especially are in many cases omitted from the consonantal writing. The weak roots (those containing weak radicals) are distinguished as I ꜣ, II *w*, III *y*, etc. (with the Roman numeral indicating the position of the radical concerned), or, in the case of *w* and *y*, which show numerous interchanges, simply I, II or III weak. Another variety of root has the last two radicals (most commonly II and III) alike. As the Egyptian, besides omitting weak consonants, never wrote two like consonants together except when a vowel sound came between them, these special types of roots assist in determining at least the position, though not the nature, of the unwritten vowels in several verb forms. The Coptic with its Greek characters shows the vowels used at that late date in the tiny fractions of the old vocabulary and grammatical forms which still survived. Other hints of the vocalization are obtained from Greek transliterations of Egyptian words, and in still fewer cases from the earlier Babylonian and Assyrian.

As in other languages, the verb is the heart of the Egyptian sentence. It follows in some measure the Semitic principle of distinguishing not among present, past and future, but between the finished (*perfect*) and the still progressing (*imperfect*) action or condition, in no matter what field of time they lie. The former corresponds roughly to our past, the latter to our present and future. But the Egyptian-Semitic analogy is very incomplete; so the usual designations of Egyptian tenses are taken directly from the paradigm-verb *śḏm,* "to hear." The simplest form is the *śḏm·f* ("he hears"), in which only an enclitic pronoun or a noun follows the root as subject of the verb. The conjugation of this tense runs:

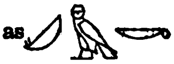
śḏm·y	I hear	*śḏm·n*	we hear
śḏm·k	thou (m.) hearest		
śḏm·t	thou (f.) hearest	*śḏm·ṯn*	ye hear
śḏm·f	he hears		
śḏm·ś	she hears	*śḏm·śn*	they hear

In the earliest texts dual forms also, similar to the plural but with *y* added (*śḏm·ny,* "we two hear," etc.), are found. The consonantal modifications in special types of roots (especially the II doubled and III weak) show that this tense was vocalized in at least three different ways, according to the shade of meaning: emphatic, declarative or optative, and circumstantial or conditional respectively.

Though the *śḏm·f* occurs in narrative also, the commonest representative of our past tense is the *n*-form *śḏm·n·f* (“he heard”). Other shades of thought are expressed by forms with *yn*, *hr* or *kꜣ* in the place of the *n*. For the passive, *tw* is attached just before the subject (e.g., *śḏm·kꜣ·tw·f*, “may he be heard”). The passive *śḏm·n·tw·f* is usually, the passive *śḏm·tw·f* sometimes, replaced in the case of noun subjects by a form *śḏm·w·f*. A causative conjugation is formed with prefixed *ś* (e.g. *ś·nfr*, “to make beautiful,” from *nfr*, “to be beautiful”).

A remnant of an older verbal system, apparently related to the Semitic perfect, uses inflectional endings, takes no suffix-pronouns, and always follows a noun subject (contrary to the *śḏm·f* usage). As it occurs chiefly in circumstantial clauses, it has been called the *pseudo-participle*. Both this and the *śḏm·f* system are used with auxiliaries to make compound conjugations closely analogous to such English forms as “I am going,” “I did go,” and “I am to go.”

The Egyptian verb is distinguished for one unique development, the *relative-form*, made in the *śḏm·f* and *śḏm·n·f* tenses by inserting masc. *w* or fem. *t* after the root. The resulting *śḏm·w·y*, *śḏm·t·n·śn*, etc., mean “(he) whom I hear,” “(she) whom they heard,” etc., and are used as nouns or adjectives.

The problems involved in translating from Egyptian texts may be realized in some measure when it is noted that such a form as  may be read *śḏm·k* (*śḏm·f* form, with at least three pronunciations and corresponding differences in meaning; or infinitive + suffix, “thy hearing,” where “thy” may be either subjective or objective), *śḏm·(w)·k* (passive in *w*; “thou art heard”; or masc. relative-form, “[he] whom thou hearest”), or *śḏm·k(wy)* (pseudo-participle 1 per. sg., “I being heard”). The context, in conjunction with fairly definite principles of word-order, must be our chief guide amid such perplexities.

The enclitic personal pronouns serve not only as verb subjects but are attached as possessives to nouns (e.g., *pr·y*, “my house”). They enter also into composition to make an emphatic absolute pronoun employed as subject of a nominal sentence (a verbless type whose English equivalent would require an indicative form of the verb “be”). Another, older set of absolute pronouns, from which the weak enclitics were derived, represents our objective case. The demonstrative pronouns in common use vary from age to age, but agree in containing *p* in the masc., *t* in the fem., and *n* in the plural. The definite article “the,” non-existent before the Empire, is a weakened demonstrative which even in the Coptic shows the same characteristic letters. There is no indefinite article until the Coptic, which uses a weakened form of the numeral “one.” The origins of both “the” and “a” in Egyptian thus parallel the developments in modern European languages, including English.

Egyptian nouns and adjectives are of but two genders, masculine and feminine. Their distinctive endings are:

masc.	sg.	none or *w*	fem.	sg.	*t*
	dual	*wy*		dual	*ty*
	pl.	*w*		pl.	*wt*

As in the verb, the dual was early lost. The prefix *m* (common in Semitic) is used sometimes to make nouns of place and especially of instrument (e.g., *m·śdm·t*, “cosmetic,” from the root *śdm*, “to paint the face”). There are two main types of adjective formation. The one, showing the simple verb root, is often indistinguishable from a participle; the other, the *nisbe* (so called from its Arabic counterpart), is made from nouns or prepositions (which were originally nouns) by adding *y* (e.g. *ḥnsk·t·y*, “curly-haired,” from the fem. noun *ḥnsk·t*, “curl;” *ḥr·y*, “[he] who or [that] which is upon,” from *ḥr*, “upon” [connected with the noun *ḥr*, “face”]). The adjective regularly follows its noun. The same close connection may exist between two nouns as between a noun and a suffix-pronoun; thus *pr·f*, “his house,” is analogous to *pr-Ymn*, “the house (temple) of Amon.” The second noun, *Ymn*, is called a *direct* genitive and is said to be in the *construct* relation with the first. That the vowel sounds are slurred in the first word of such a phrase, whose emphasis naturally falls at the end, is clearly shown by Coptic spellings. Under other circumstances an *indirect* genitive is used, preceded by the declinable adjective *ny*, “of,” nisbe of the preposition *n*, “to.” Modified forms of adjectives and of prepositions furnish the few and heterogeneous adverbs.

Literature.— The Egyptian language, whose mechanism has just been noticed, has left an extensive literature, characterized by a concreteness of thought as vivid as the concrete pictures with which it is written. Amid the maze of inscribed records which the dry climate of Egypt has bequeathed us, the field most largely represented is religion. From the Old Kingdom, 4,500 years ago, come the “Pyramid Texts,” the earliest large body of literature yet known from any source. A trust in mere massivity of the tomb to preserve royal bodies and so win for them life hereafter was thus early felt inadequate. So during the V. and VI. Dynasties the corridors of five pharaohs' pyramids were inscribed with varying collections of hymns, prayers, rituals, and magic formulæ, in part already hoary with age, calculated to make doubly sure the felicity of the royal dead. Religious texts whose benefits may be shared by all classes are found on the coffins of the Middle Kingdom, and at greater length on long rolls of papyrus (the so-called “Book of the Dead”) in the Empire and down through the Restoration. Contrasting with the traditional cults of the living, a monotheism earlier than the Hebrews' speaks (about 1400 B.C.) in the great hymn of its royal founder, the emperor Ikhnaton.

History is represented on the one hand by fragments of royal annals, annotated royal reliefs and hymns of victory. On the other are memorial records left by expeditions abroad, and the more intimate data derived from autobiographies which nobles and high officials have left carved in their tombs.

The classic age, the Middle Kingdom, is richly productive of philosophy. Satisfaction with the traditional order is evident in a set of maxims, the Wisdom of Ptahhotep, suggestive of the biblical book of Proverbs. But pessimistic tendencies appear in a misanthrope's dialogue with his own soul on the wretchedness of a wronged and unappreciated life. Another writer looks beyond present misery to a messiah who shall establish justice. Eloquence as such is more prominent than the righting of grievous wrongs in a fourth composition, the Laments of the Peasant.

The same fondness for affected language permeates the Middle Kingdom tale of Sinuhe (see Fig. 2), a historical novel depicting the supposed adventures of a fugitive Egyptian courtier of that name in Palestine over five hundred years before the coming of the Hebrews. Even love-songs survive from the late Empire.

Science, represented by mathematics and medicine, was clearly cultivated for practical purposes only; for the mathematical formulæ are very inexact, and the medical prescriptions are in large part based on magic.

Bibliography.—A fuller picture of Egyptian literature proper, with translations, may be gained from Breasted, ‘Development of Religion and Thought in Ancient Egypt’ (New York 1912), and Maspero, ‘Popular Stories of Ancient Egypt’ (New York 1915). On the technique of the writing, consult Breasted in *The American Journal of Semitic Languages and Literatures* (July 1916, pp. 230–49, ill.). English readers have as yet no handy volume on the subject of hieroglyphics in general, such as Germans enjoy in Erman, ‘Die Hieroglyphen’ (Berlin 1912).

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HIERONYMUS. See Jerome, Saint.

HIEROSOLYMA. See Jerusalem.

HIGGINS, Anthony, American politician: b. Red Lion Hundred, Del., 1 Oct. 1840; d. New York, 26 June 1912. He was educated at Yale, studied at Harvard Law School and was admitted to the Delaware bar in 1864. From 1869 to 1876 he was United States attorney for Delaware, and becoming interested in politics was chairman of the Republican State Convention in 1868. In 1881 he secured the vote of the Republican members of the Delaware legislature for the United States Senate and in 1884 was defeated as a Republican candidate for Congress. He was United States senator 1889–95. He was counsel for Judge Charles Swayne in his impeachment in 1905.

HIGGINSON, Ella Rhoads, American novelist and poet: b. Council Grove, Kan., 1862. She was married to R. C. Higginson and has passed her life mainly in the vicinity of Puget Sound, Wash. She has contributed much to periodicals, and her work, which has a distinctly original flavor, has attracted much attention from its vigorous presentation of life on the upper Pacific slope. She is in charge of the literary department of the Seattle *Sunday Times,* and is a member of the National Geographic Society. Her most noteworthy book is ‘Mariella, or Out West,’ an extremely strong novel (1902); and other works of hers are ‘The Flower that Grew in the Sand’ (1896); ‘From the Land of the Snow Pearls’ (1897); ‘A Forest Orchid’ (1897); ‘When the Birds Go North Again,’ poems (1898); ‘The Voice of April Land,’ poems (1906); ‘Alaska, the Great Country’ (1908); ‘The Takin' In of Old Mis' Lane,’ prize short story; ‘The Vanishing Race,’ poems (1912); ‘The Message of Anna Láura Sweet’ (1914) and several collections of poems.

HIGGINSON, Francis, English clergyman in colonial America: b. 1587; d. Salem, Mass., 6 Aug. 1630. He was educated at Cambridge, England, and subsequently became rector of a parish in Leicester, but becoming gradually a Non-Conformist, was deprived of his benefice, and was employed among his former parishioners as a lecturer. While apprehending a summons to appear before the High Commission Court, he received an invitation from the Massachusetts Company to proceed to their colony, which he accepted. He embarked in May 1629, and it is related by Cotton Mather that as the ship was passing Land's End, he called the passengers about him and exclaimed: «We will not say, as the Separatists were wont to say at their leaving of England, ‘Farewell, Babylon; farewell, Rome!’ but we will say, Farewell, dear England! farewell, the church of God in England, and all the Christian friends there. We do not go to New England as Separatists, though we cannot but separate from the corruptions of it. But we go to practise the positive part of church reformation, and propagate the gospel in America.» He arrived at Salem 29 June, and on 20 July was chosen teacher of the congregation established there. Subsequently Higginson drew up «a confession of faith and church covenant according to Scripture,» which on 6 August was assented to by 30 persons, who associated themselves as a church. He wrote ‘New England's Plantations, or a Short and True Description of the Commodities and Discommodities of the Country’ (1630), and an account of his voyage, printed in Young's ‘Chronicles of the First Planters’ (1846). Consult Higginson, T. W., ‘Life of Francis Higginson’ (1891).

HIGGINSON, Francis John, American naval officer: b. Boston, 19 July 1843. In 1861 he was graduated at the United States Naval Academy; was promoted through the various grades, becoming rear-admiral on 3 March 1899. In 1861–62 he served on the *Colorado* in the West Gulf blockading squadron; was wounded at Pensacola Harbor, and took part in the bombardments and passage of Forts Jackson and Saint Philip. He was present at the engagements with the Chalmette batteries and at New Orleans. He served on the *Vixen* in 1862 and on the *Powhatan* in 1863–64. Becoming attached to the South Atlantic blockading squadron he participated in the bombardment of Fort Sumter and was on board the *Housa-*

tonic when she was blown up by a torpedo off Charleston. After the war for 30 years he served all over the world in various squadrons and in various capacities at the naval stations at home. In 1897–98 he commanded the *Massachusetts* and was advanced three numbers in rank for eminent and conspicuous conduct in battle during the Spanish-American War. In 1901–03 he was commander-in-chief of the North Atlantic fleet and from 1903 to 1905 commandant of the Washington navy yard. He was retired 19 July 1905.

HIGGINSON, Henry Lee, American banker: b. New York, 18 Nov. 1834. He was educated at Harvard, studied music abroad and served in the Federal army during the Civil War and was brevetted lieutenant-colonel. He has been long connected with the Boston banking and brokerage firm of Lee-Higginson & Co., and has contributed large amounts toward the organization and support of the Boston Symphony Orchestra. He was elected a Fellow of the Harvard Corporation in 1893. He is a member of the Massachusetts Historical Society, and the American Academy of Political and Social Science. His charitable benefactions have been numerous and his activity in the field of social service has earned for him the title of «Boston's first citizen.»

HIGGINSON, Mary Thacher, American author, wife of T. W. Higginson (q.v.): b. Machias, Me., 27 Nov. 1843. She has written 'Seashore and Prairie' (1876); 'Room for One More' (1879); and 'Such as They Are' (1893), poems written in collaboration with her husband; 'The Playmate Hours,' poems (1904); 'Thomas Wentworth Higginson: The Story of his Life' (1914).

HIGGINSON, Thomas Wentworth, American author: b. Cambridge, Mass., 22 Dec. 1823; d. there, 10 May 1911. He was descended from Rev. Francis Higginson (q.v.); was graduated from Harvard in 1841, and from Harvard Divinity School in 1847. He became pastor of a Unitarian church in Newburyport, Mass., in 1847, but resigned in 1850, his anti-slavery views being unacceptable to his congregation. In the year last named he was the unsuccessful «Free Soil» candidate for Congress, and he was pastor of a Free (unsectarian) church at Worcester, Mass., 1852–58. In the interim he had been prominent in anti-slavery agitation, and for his share in the attempted rescue of the fugitive slave Anthony Burns (q.v.), was indicted for murder in 1854 with Wendell Phillips, Theodore Parker and others, but owing to a flaw in the indictment the defendants were discharged. He also aided in the Kansas Free State efforts, and during the Civil War was captain of the 51st Massachusetts regiment of volunteers, becoming colonel in November 1862 of the 1st South Carolina Volunteers, the earliest regiment of freed slaves in the Federal service. He resigned from the army in October 1864, by reason of disability, and thereafter gave his attention to literature, residing at Cambridge, Mass., since 1878. He was almost a life-long and consistent advocate of woman suffrage and of the higher education of woman, and was a member of the Massachusetts legislature 1880–81, serving on the State board of education also, 1881–83. He was a polished, graceful speaker, and frequently appeared on the lecture platform. He was the Lowell lecturer on American literature in Boston in 1902. As an after-dinner or occasional speaker he was especially happy, his felicitous sentences being almost always illuminated by the play of a very delicate humor. He was president of the Round Table, a social Boston club, and vice-president of the Boston Authors Club, as well as a member of many other organizations, social and literary. He was for a generation a constant contributor to periodicals of the highest class and figured in literature as essayist, novelist, poet and historian. His principal work in fiction is 'Malbone' (1869), in which his first wife is outlined as Aunt Jane. As an essayist he is perhaps seen at his best, the essay form seeming peculiarly adapted to his genius. Among collections of essays by him may be cited 'Outdoor Papers' (1863); 'Atlantic Essays' (1871); 'Women and Men' (1887); 'The New World and the New Book' (1891); and 'Concerning All of Us' (1892). His 'Young Folks' History of the United States' (1875) has been widely popular, and other histories by him are 'Larger History of the United States' (1885); 'English History for Americans' (1893); 'Massachusetts in the Army and Navy, 1861–65' (1895–96). His verse is included in 'The Afternoon Landscape' (1889); 'Such as They Are' (1893). Yet other important works by him are 'The Monarch of Dreams,' a strikingly original sketch (1886); 'Army Life in a Black Regiment' (1869); 'Cheerful Yesterdays' (1898); 'Old Cambridge' (1899); 'Contemporaries' (1899); and lives of Margaret Fuller (1884); Francis Higginson (1891); Henry W. Longfellow (1903); John Greenleaf Whittier (1903); 'History of the United States' (1905). He translated the complete works of Epictetus (1865, revised ed. 1891). With Samuel Longfellow (q.v.) he completed a well-known anthology of seaside verse, 'Thalatta' (1853), and with Mrs. E. H. Bigelow 'American Sonnets' (1890). Several of his works have been translated into French, German, Italian and even modern Greek. He was the friend of very many of the older New England writers and was especially helpful to many of the younger ones, not a few of whom owe him much in the way of kindly criticism or suggestion, the fruit of ripe scholarship.

HIGH BRIDGE, Engagement at. See Farmville.

HIGH CHURCH, a term applied to a faction in the Church of England. It was applied first to the younger clergy during the latter part of the reign of Elizabeth who asserted that Calvinism was inconsistent with the ancient doctrine and constitution of the primitive Church, and who claimed a divine right for episcopacy. Bishop Andrews was the chief writer of this faction, and Laud became its most active leader. The term now generally refers to those who exalt the authority and jurisdiction of the Church, and attach great value to ecclesiastical dignities and ordinances, being more or less identified with the ritualistic party. See Ritualism.

HIGH EXPLOSIVES. See Explosives and related references.

HIGH-FREQUENCY OSCILLATING CURRENT. This term is especially applicable to electrical currents, the high-frequency interruptions of which are obtained by means of condenser discharges in contradistinction to those produced by a disrupted static current, without the interposition of a metallic condenser in series with one or both terminals. The latter differs in several characteristics and is essentially a high potential current, 10,000 to 50,000 volts, with a minimum amperage, usually about .0005. The usual alternating current in commercial use in the United States is that known as 60-cycle: that is, it makes 60 complete journeys — there and back, so to speak — in each second. It has changed its direction, therefore, 120 times in the second. The high-frequency current changes its direction 20,000 times or more per second.

To generate a high-frequency current it is usual to charge two Leyden jar condensers with a high potential current, the source of which may be a static machine or induction coil, shunting the two wires with a spark-gap for the purpose of disrupting the current. The external armatures of the condensers are short-circuited through a solenoid or helix consisting of a few turns of very coarse copper wire (D'Arsonval). The helix may be substituted by a straight copper bar (Sheldon). The helix prolonged to from 50 to 100 turns constitutes the resonator of Oudin. The upper part of the helix resonates in unison with the lower, when properly in tune, as would a tuning-fork resonate with another of the same pitch. The office of the extended helix is to amplify the current.

Another arrangement is after Tesla: The primary of a specially constructed induction coil is energized by an alternating current. The secondary terminals, giving a potential of 15,000 volts, are connected, one to each side of a suitable condenser. From each of these terminals a shunt is taken. One leads to one end of the primary of a Tesla coil; the other, broken by a spark-gap, is connected to the second terminal of the primary. The frequency obtained from the Tesla apparatus is fabulously high — millions a second. The potential may be hundreds of thousands or millions of volts. The amperage is sufficient to light to full candle-power several incandescent lamps. The primary of the induction coil consumes 15 to 25 amperes. For maximum high-frequency effects this type of apparatus seems to be essential. There are many modifications of this apparatus.

At the terminals of a working high-frequency apparatus is seen a beautiful brush discharge or effluve of a peculiar violet color, which will leap to any object brought near it. These brush discharges range from 20 inches upward to 50 inches in length. Interpose a plate glass one-half inch thick (or more), and the effluve will penetrate it. If the object be a vacuum tube it will glow almost as brightly as if nothing intervened. It is an ideal current for igniting Geissler and low-vacuum X-ray tubes; only one terminal need be connected.

One characteristic of the high-frequency oscillating current is its lack of power to excite the motor nerves, and, aside from a slight sensation of warmth, the sensory nerves at the point where the electrode touches the body. The accepted explanation for this fact is, that the nerves respond to certain frequencies of stimulus; for the motor nerves, reaction takes place up to about 5,000 frequencies; if these are gradually increased muscular contraction diminishes and finally ceases. This theory is in line with reasoning as to the cause for action of the special senses — sight and hearing.

The high-frequency discharge is a rich ozone generator, and, applied to unhealthy granulations and various skin diseases, acts as an oxidizer, antiseptic and disinfectant. Applied to the skin before incision, it will render the site aseptic. In the hands of the expert electric physician the high-frequency current is used to remedy several diseased conditions. The vacuum-tube is employed to increase arterial tension, the D'Arsonval current to decrease it. The former is productive of a powerful tonic effect in cases where the blood pressure is normal, but is dangerous where arterio-sclerosis exists. The vacuum-tube application increases the blood supply to the part under treatment, resulting in an improvement in nutrition at that point. Its application is also marked by an increase of the functions of excretion and secretion. The high-frequency current has been used successfully in renewing the growth of hair where the follicles have not been destroyed, and in many cases has restored the original color to hair which had turned gray. The treatment is also efficacious in corpulency. For a general tonic effect the patient is placed upon an auto-condensation couch or in the centre of an auto-conduction cage. In the treatment of sub-acute and chronic rheumatism, sciatica, neurasthenia, etc., it is most useful. (See ELECTROTHERAPEUTICS). Consult Curtis, T. S., 'High Frequency Apparatus: Its Construction and Practical Application' (New York 1916); Transtrom, H. L., 'Electricity at High Pressures and Frequencies' (Chicago 1913).

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HIGH-POTENTIAL SYSTEM. See ELECTRICAL TERMS.

HIGH PRIEST, the head of the Jewish priesthood. In the books of Moses the holder of this dignity is simply designated the priest, the epithet high occurs on one or two occasions, but as a distinctive epithet it appears to have been added subsequently. The formal consecration of Aaron, the brother of Moses, together with his sons, to a hereditary priesthood, is recorded in Ex. xxviii. The high-priesthood continued in the line of Aaron, sometimes in one, and sometimes in another branch of it, until the coming of Christ. After the subjugation of the Jews by the Seleucidæ, the Ptolemies and the Romans, it was often arbitrarily conferred by the foreign masters. The dignity of the priest's office is indicated by the splendor and costliness of his garment, which was among the most beautiful works of ancient art. To the high priest belonged the regulation and superintendence of the worship of God, the declaration of the oracles of Jehovah to the people (he alone being permitted to consult them on important public occasions), and the preservation of the national sanctuary. Although the administration of justice was committed to particular judges, yet to him the last appeal was made in difficult cases, even in temporal affairs, and nothing important in war or peace could be undertaken without his assent.

HIGH SCHOOLS. The high school as commonly interpreted is distinctively an American institution. The term is applied to those schools which ordinarily give a four-year course of study to students who have completed eight years in the elementary school. The course is rarely longer and is sometimes shorter than four years.

These schools grew up in the early history of the United States to supply a distinct need. The state was providing an education for the people in the elementary schools. Those families which were intending to send their children to college sent them to Latin schools which received pupils at the age of 10 or 11 and gave them a course of six years. For entrance to these there was demanded a preliminary education of approximately six years.

To answer the demand of those who did not intend to send their children to college there grew up in the United States private academies which received pupils before they had finished their elementary course of eight years or after such a course had been completed. The academy therefore usually furnished a pre-academic course for the former and the academic course of four years for the latter. Students could go from the academy to a college, but this was not the prime motive of the institution.

The academy was private, charged tuition fees and in a way was intended for people of means. A demand arose for an institution to which pupils could go who had finished the elementary school course, which should be free and prepare its graduates to enter the pursuits of practical life. The English High School of Boston, founded in 1821, was the first of its kind, and gradually, as free elementary schools were established throughout the country, the high schools soon followed. The academies gradually died out.

The high schools were essentially democratic in origin and were not intended to prepare students for college. With the passing of the academy, however, and in view of the fact that, except in the older States along the Atlantic seaboard, the Latin school was unknown, there developed a demand that the high school of the community should offer courses which would prepare students for college. As the principals and the teachers of the high schools were frequently products of the colleges, they lent willing ears to such demands and the high schools came at times to take on the character of college preparatory schools, and their original ends were lost sight of. Even the pioneer of them, the English High School of Boston, felt called upon to offer a special year to prepare its graduates for college.

The studies offered in the high school, too numerous to be mentioned here, came to be grouped into the classical course, which had for its object the preparation of pupils for college, and the literary and scientific courses which aimed to prepare students either to go out into the world of business or to enter technical institutions.

The dominating influence, however, was collegiate and the introduction of business and industrial subjects was gradual, and was often met with active hostility by the teaching force. The students and the teachers in the classical course looked down on the pupils who pursued the business or commercial and manual training courses. The result was that these led a stifled existence. In communities, where the high school population became large enough, the commercial students were drawn off and placed in a separate commercial high school, others in a manual training or technical or mechanic arts high schools. Once separated from the classical, these new high schools began to develop rapidly into strong institutions. So large did they grow that the colleges, which had hitherto felt that the only kind of preparation which could possibly fit students for collegiate work must be that of the classical high schools, now began to rearrange their entrance requirements so that graduates of not only classical but of the other high schools could enter their walls.

In size high schools now range all the way from institutions housing over 5,000 pupils, as in New York city, to small country institutions of only three or four classes. In a community where only one high school exists it is usual to find the classical, literary, commercial, manual and scientific courses all given in one building. The buildings and equipment of some of the high schools and the courses offered both in the East and West frequently rival and outshine colleges and universities, and so important are they in some communities that they are called the «people's colleges.»

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HIGH SEA, The. All the waters of the ocean, which are not included in the territorial limits of any nation, and over which no nation can rightly claim supervisory or exclusive jurisdiction, are included by the term «high sea.» A state's territory extends over its adjacent waters to a line following the sinuosities of the coast at a distance of one marine league, to all harbors, and to the mouths of rivers and to straits and bays, when embraced by headlands not too remote from each other. There is no general rule as to the distance between headlands which determines the character of the waters enclosed by them; but the Bay of Fundy, the mouth of the Amazon and the Strait of Dover, for instance, are unquestionably parts of the high sea, while Chesapeake and Delaware bays would properly be considered territorial waters. The high sea is free to all nations for commerce or fishing or any other lawful use; but this right has been conceded only partially and in comparatively recent times. Powerful maritime nations, ancient and modern, have asserted superiority and exclusive jurisdiction commensurate with their ability to compel obedience from those weaker than themselves. The Phœnicians would permit ships of no other nationality to pass the Pillars of Hercules out into the Atlantic; the Greeks at Byzantium barred others from the Euxine. For nearly 1,000 years, however, the freedom of the high sea was maintained by the Pax Romana; the Romans included even the rivers in the common liberties — *flumen publica sunt; hoc est populi Romani* — Institutes 2, title 1, sec. 2. But the unsettled conditions following the disintegration of the Roman Empire were not brought to a tolerable state of order until, toward the end of the 12th century, a system of maritime law found general acceptance and was embodied in various compilations of ancient and mediæval maritime usages and customs, in which the Roman idea of the high sea as a common human possession is assumed, though not declared, as a basic principle. This principle was controverted however by claims arising out of the great discoveries made toward the close of the 15th century. Vasco de Gama had doubled the Cape of Good Hope and made the voyage to India; Columbus had opened the way to the western continent. By the famous *bulla* of Pope Alexander VI the worlds thus newly disclosed were partitioned between Spain and Portugal, in whose service the great discoverers had sailed. The grantees, who were then and long after the leading maritime powers, asserted, and enforced, the right to exclude all other nations from the oceans as well as the lands divided between them by the papal grant. More particularly, the Spaniards asserted the Pacific and the Spanish Main to be their own by right of discovery, while the Portuguese, by the same right, insisted upon exercising sole dominion over the Indian Ocean. The circumnavigation of the globe by Francis Drake was in open defiance of the pretensions of both, and Hugo Grotius, in his celebrated treatise *De Mare Liberum,* which appeared in 1609, riddled their preposterous claims.

The plea of Grotius for complete freedom of the seas went unheeded, and the rivalry between the English, Dutch and French as colonizing and maritime powers brought forth jurisdictional claims over the ocean highways scarcely less objectionable than those previously asserted by Portugal and Spain. It was the exaggeration of belligerent rights at the expense of neutrals during the ensuing two centuries of war for maritime and colonial supremacy that caused the most trouble, however. The armed neutrality, established by the North European powers in 1780 under Russian leadership, was the first concerted effort of the weak to protect themselves against the arbitrariness of the strong in naval power. The objects of this concert of lesser naval powers were the limitation of contraband to actual war material, to immunize other neutral property, ships included, from seizure and confiscation on the high sea, and to sustain the right of neutrals to carry on oversea trade in innocent products with all belligerents without interference from either of them. From its very beginning the American government stood out for the greatest possible freedom of high sea commerce, even in time of war, and the principle expressed in the slogan, «free ships make free goods,» carried the immunities proposed by the armed neutrality a step further, by extending protection to enemy property when transported in neutral ships. But the American commissioners sent to France in 1793 to secure adherences to this principle were able to obtain only a single treaty embodying the same, that with Prussia, signed by Franklin and his associates at Brussels in 1799. Twenty-five years later a proposal «to abolish private war at sea and restrict contraband» was simultaneously submitted by this government to all the leading European powers. «Exemption of private property at sea from destruction and the depredations of war is offered to the civilized world by the United States,» wrote Secretary Adams to Middleton, the American Minister at Paris on 13 Aug. 1823. The offer was again rejected; this government, however, not only steadfastly maintained its position, but advanced it as time ran on. When the United States were requested to become parties to the Declaration of Paris, the answer was conditionally affirmative. This government would become a signatory if the Declaration should be amended by this addition: «Private property of subjects and citizens of belligerents on the high sea shall be exempt from seizure by public armed vessels of the other belligerents, except it be contraband.»— President Pierce, 4th annual message, 1856. Even in the throes of the Civil War this government was prepared to forego the advantage of naval capture of enemy shipping and other property on the sea for the sake of establishing a principle in which it believed. «We must claim for ourselves the rigors which other maritime powers apply to us when we are neutrals. But even to-day, in the midst of this strife, if the other powers, including Great Britain, should agree to abolish naval blockades altogether and forever, and to exempt private property from confiscation in maritime war, we are prepared to consider the proposal.»— Secretary Seward to Minister Dayton at Paris, 28 Feb. 1862. The trend of opinion in later years among international jurists seemed to be toward the American idea of complete freedom of high sea commerce in war as well as in peace. The British delegates to the second peace conference at The Hague in 1907 had instructions from Sir Edward Grey, Minister for Foreign Affairs, to agree to the abandonment of high sea captures and the complete abolition of contraband. But the «Convention Relative to Certain Restrictions with Regard to the Exercise of the Right of Capture in Naval War,» which was adopted by the conference, left matters practically where they stood. It merely immunized postal correspondence, inshore fishing vessels and small boats operated exclusively in coastal waters. The Declaration of London, formulated and adopted by the maritime conference of 1908, failed of ratification, though it was merely declaratory of prevalent usages and gave undiminished recognition to the right of capture on the high sea. The total disregard of conventions and morals by belligerents in the World War necessitates a complete reformation of the law of the sea, and its enforcement by a supernational authority.

With respect to navigable rivers, flowing to the sea through the territory of more than one nation, the Roman principle, *flumen publica sunt,* has obtained partial recognition. The Rhine was opened to all nations by the Congress of Vienna; the Danube is open, but under control of the International Danubian Commission. Secretary Marcy, in his instructions of 8 Aug. 1853, to Trousdale, United States Minister to Brazil, declared: «The right to peacefully navigate the Amazon River belongs, in international law, to all maritime states.» In a report of 18 March 1792, Jefferson insisted that, "where rivers enter the limits of another society and the rights of the upper inhabitants to descend (or ascend) is obstructed, it is an act of force by a stronger against a weaker nation and condemned by the judgment of mankind." So far as the Mississippi is concerned, controversy has been closed by the inclusion of the entire stream within the territorial limits of the United States. Access to the sea from the Great Lakes has been subjected at various times to various policies; but the Treaty of Washington (8 May 1871) finally declared that "navigation of the Saint Lawrence, ascending or descending, from the 45th parallel of North latitude, shall forever remain free and open for the purpose of commerce to citizens of the United States." Reciprocally, Lake Michigan, which is enclosed entirely by territory of the United States, was made free to British subjects. No laws or police regulations inconsistent with such freedom may be made or enforced in either case; and, by later arrangement, there has been established a perfect equality in the use of all canals and rivers traversed by or contiguous to the boundary and communicating with navigation on the Lakes. Straits giving access to enclosed seas are considered parts of the high sea. The imposition by Denmark of Sound dues at the entrance to the Baltic had been submitted to by commercial nations, because of their antiquity and because of an unwillingness of the great powers to coerce a weak state (see DANISH SOUND DUES). Secretary Buchanan (manuscript instruction of 14 Oct. 1848) pronounced these exactions to be "inconsistent with just principles of international law," and President Pierce (3d annual message, 1855) insisted upon the right of free transit into and from the Baltic. A convention making the Belts and the Sound free to navigation by American vessels was ultimately signed 11 April 1857, and this extended, of course, to the citizens or subjects of all states entitled to the treatment of "most favored nations." The Dardanelles were opened to the free transit by commercial shipping of all nations by the Treaty of Paris, 1856. The great interoceanic canals of Suez and Panama have been declared open on terms of equality to the vessels of war and of commerce of all nations. "The government of the United States will not tolerate exclusive claims by any nation whatsoever to the use of the Straits of Magellan and will hold any government responsible that undertakes to obstruct the same by imposts on commerce."— Secretary Evarts, manuscript instructions, Chile, 18 Jan. 1879. Crimes committed on the high sea are under the jurisdiction of the nation whose flag is flown by the vessel on which they occur. Collisions of vessels of different nationality are properly subject to inquiry in any admiralty court which first obtains jurisdiction.

STEPHEN PFEIL.

HIGH TREASON. There is a well-known epigram of Sir John Harrington, often quoted for its supposed wit and truth, though it possesses little of either of these qualities, which goes as follows:

> Treason never prospers. What's the reason?
> When it doth prosper, none dare call it treason.

To be sure, when an attack on established order has met with success the victors do not prosecute themselves for treasonable conspiracy. A new polity has come into being, the life of a nation has taken a new point of departure and a new direction, and the former legal sanctions have come to an end. In assuming that an accomplished revolution is nothing more than successful treason, the epigrammatist betrays a shallow way of thinking and an utter lack of appreciation of the fact that the mutability of human institutions is the condition of progress. Indeed, it may be, in the case of an insurrection which has attained the dimension of civil war, that the participants on either side will regard those on the other as enemy combatants, entitled to treatment as such, when made prisoners of war, in accord with the law of nations, and not as common criminals, to be hanged when caught. In the American War of Independence, as well as in the war between the States, the opponents tacitly treated each other as belligerents. The statute of 11 Henry VII, chap. 1 (1494) distinctly provides that obedience to a king *de facto*, but not *de jure*, shall not expose the adherents of the former to penalty for high treason when the rightful sovereign is re-established in power. On the contrary, however, all systems of law make it treasonable to commit any overt act (Fr. *attentat*) the purpose of which is to destroy or change the existing government; to arm citizens, or incite them to arms, for war against the public authorities; to attack the armed forces of the state, or public property, buildings, fortresses, arsenals, ships, etc., or take possession of the same for use against the state. These and other similar acts, which are specified in the French law of *Lèse Majesté*, are comprised in the English term "levying war," which neither the laws of Great Britain nor the United States more closely define. In strict law, therefore, all those who had taken part in an insurrection that failed would be punishable criminally as traitors, irrespective of the nobility or ignobility of their cause.

Glanville in a brief note on the crime indicates that compassing the death of the sovereign, insurrection or concerting with the external foes of the realm were impeachable (*infamatur*) whether or not a prosecutor appeared to make the accusation. Bracton describes the crime under the title *Laese Majestatis* and his description bears a recognizable likeness to the Roman law of *Majestas*. In his enumeration of the acts constituting treason, Bracton leads off with "The manifestation by action of a will to procure the death of the king; to foment rebellion against him; or to adhere to his external enemies." The resemblance in matter, and in the order of statement, to the Statute of Treason is remarkable; and that this is not accidental is suggested by the fact that the words of the statute, "compassing or imagining the death of our lord the king," might pass for a translation from Bracton. The Statute of Treason (25 Edward III, A.D. 1352) is not only the foundation of the English law on the subject, but contains the major part of it. Disregarding certain provisions for the safety of the king's family and the heir to the throne, the statute declares treason to be

(1) forming and displaying by any overt act an intention to kill the king; (2) levying war against the king; (3) adhering to the king's enemies. As Lord Justice Stephen remarked, it makes no provision for acts of violence against the king's person unless they display an intention to take his life. Nothing is said of attempts to imprison or depose him, or to interfere with his unquestioned prerogatives; nor about disturbances of the peace, however violent, which fail to reach the point of actual levying of war. It fails even to mention attempts or conspiracies to levy war. In enacting the measure Parliament seems to have been less concerned for the security of the state than for the security of persons and its purpose seems to have been to make a definition of treason that would exclude perjuries in office, waste of the king's revenue or counterfeiting or clipping his coin, and similar offenses, which had been so accounted. The crown was secure enough. The Scots were troublesome on the border, but domestic tranquillity seemed assured; the Constitution had been settled and the political institutions of the kingdom had taken practically the form which they have ever since maintained.

The omissions of the statute soon made themselves apparent in the tempestuous reign of Richard II. Acting in its judicial capacity, and overriding the jurisdiction of the courts, the House of Lords, in 1388, impeached the archbishop of York, the Lord Chief Justice, the lord mayor and others for treason, in having led the king to misgovern the country. The traitors were convicted and some of them executed. Ten years later the accusers were in turn impeached by the king's party. The Duke of Gloucester, uncle of the king, who had been the prime mover in the former prosecution, was assassinated, the Earl of Arundel was executed and the Earl of Warwick, who had been sentenced to be hanged, drawn and quartered, was remanded to imprisonment for life. A statute of Richard II, passed two years before his deposition, is described in the repealing act (1 Henry IV, chap. 10) as having left matters in such doubt that «there was no man which did know how he ought to behave himself, to do, speak or say.» The War of the Roses, contrary to what might have been expected in that era of depositions and usurpations, passed without changes in the letter of the law. This is not to say, however, that every turn of political fortunes did not bring its score of attainders and executions. In the time of Henry VIII a great variety of new treasons were defined and the heads of many good men, including Thomas More, author of 'Utopia,' fell under the ax. It had become misprision of treason to assert the papal authority, and high treason to refuse to take the oath of abjurgation; to will or wish or desire, or by any craft to imagine, any bodily harm to the king or queen or heir to the throne or to deprive either of them of their titles or regal powers; to utter slanders or libels pronouncing the sovereign a heretic, tyrant, infidel or usurper; to question the legality of some of his marriages or to assert the legality of others. These «war measures,» which were repealed immediately on Henry's death, had been intended to fortify him in his opposition to the Pope, and to assure the royal succession in his heirs by making it dangerous to question their legitimacy. One of the first acts of Queen Mary's reign was to restore the statute of Edward III in its integrity by a general repeal of all treason laws subsequently enacted. Since then no permanent additions were made to the statute until the reign of Victoria. A curious law passed in Mary's reign declared it treasonable to «pray that God would shorten the life of the queen.» This was re-enacted in the time of Elizabeth and made applicable to her. A statute of Elizabeth making it treason for a priest to grant absolution for disloyalty to the Crown was continued in the reign of James I. By the statute 13 Charles II, chap. 1, it was declared high treason to display, «by writing, preaching or malicious speaking,» any intention to depose the king or to do him bodily harm tending to his death, wounding or imprisonment. All of these laws and one or two others not mentioned have expired by limitation or become obsolete.

The meaning of the words of the Statute of Treason had been greatly extended meanwhile by judicial interpretation. In the case of the Earl of Essex the judges advised that it was rebellion when a subject attempts to put himself in such strength that the sovereign will be unable to resist and govern according to his own royal authority and direction; also, that in every rebellion the death of the sovereign must be presumed in law to be the consequence of success, «for the rebel will never suffer that king to live and reign, who might punish or take revenge of his treason or rebellion.» Conspiracy to levy war, which might manifest itself in words spoken or printed, though not treasonable according to the letter of the law, was considered an «overt act» for «compassing or imagining» the death of the sovereign, and, therefore, evidence to prove high treason. Like effect has been given to concerting with foreigners or others to invade the kingdom, or to go, or even purpose going abroad, with that end in view. Nor would armed violence have to be carried into England to prove an intent to compass the death of the sovereign; the statute was held to refer not to the natural life of the king but to his political existence. A conspiracy to invade Canada and an insurrection in Ireland were both regarded evidence of an imagining of the king's death. In drawing the line between tumultuous petitioning and levying war the courts have not been consistent. The most authoritative is Lord Mansfield's pronouncement (A.D. 1780) with respect to the Gordon riots: «If this multitude assembled with the intent, by acts of violence, to compel the legislature to repeal a law, it is high treason.» But Lord Gordon was acquitted. The trials of Hardy, Horne Tooke and others in 1794 involved interpretations of the meaning of the words «imagining the king's death.» The charge was a conspiracy to depose the king and put him to death, and the overt acts alleged were: Consultations to procure a convention to be assembled with intent to subvert the government; the circulation of books and pamphlets recommending the choice of delegates; consultations concerning the call of the convention; and the provision of arms for treasonable purposes. The purpose of the agitators was to obtain universal suffrage, annual parliaments, and the alleged design to depose the king and set up a republic was not proven. The prosecution failed.

The Constitution of the United States declares that «treason shall consist only in levying war against the United States or adhering to their enemies, giving them aid and comfort.» In making this very close definition the founders of the republic were, no doubt, affected by the judicial interpolation of «constructive treason» into the words of the English statute, by the numerous prosecutions and convictions in England for «petty» treason, and the frequency with which the law against the subversion of the state had been invoked as the means of suppressing political agitation and of punishing men merely for their opinion. Therefore, nothing less than a purpose to overthrow the government by armed force, when manifested by an overt act of violence, was to be regarded as levying of war constituting treason. Prior to the Civil War period there were only two important prosecutions for this crime in the United States, and the leaders of the Whisky Rebellion of 1794, though convicted of treason, were afterward pardoned by the President; while Aaron Burr, who had been charged with the design to conquer the southwestern territory of the United States in connection with his hair-brained enterprise against Mexico, was acquitted. The difference between tumultuous assemblies, riots and insurrection is held in this country to be a difference in character, not merely in degree. Disturbances of great violence, extending over large areas, including several States, though practically subverting the public authority for a time and requiring the intervention of Federal troops, have not been regarded as levying of war, a purpose to overthrow the government not being shown. But the seizure of an arsenal by John Brown was deemed sufficient proof of such a purpose. The provision which defines treason as adherence to the enemies of the country, or giving them aid and comfort, allows American legislators greater latitude. This provision becomes active only in times of war; but it is precisely at such times that the safety of the state requires a sharpening of the terms of the law as well as of the methods of its enforcement. The formation of secret societies and conspiracies, the utterance of slanders or libels against the government, opposition to its policies or military measures by agitation, as well as by physical obstruction, or anything that tends to hinder or embarrass the government in the conduct of war, may, in such times, take the aspect and color of treason; and all the things referred to might be so declared, because of the aid and comfort they would possibly give the enemy. A public speech, a published writing, a confidential correspondence, a secret conference would, either of them, be a sufficient overt act. As for intention, the law presumes every person to intend that which follows as a natural consequence of his action. In practice, however, American war measures against the giving of moral aid or comfort to the enemies of the nation have been in the form of sedition laws. Actual consorting or conspiracy with the enemy would, of course, constitute high treason. The Articles of War, which are part of the statutory law of the United States, declare corresponding with the enemy; relieving the enemy with money, victuals or ammunition; or harboring or protecting an enemy, to be capital crimes. See MILITARY LAW.

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HIGHBINDERS, a name given to a secret organization among the Chinese in the United States which has caused much bloodshed in the Chinese quarter of San Francisco, Cal., necessitating intervention on the part of the authorities. The Chinese call these societies «hatchet» societies, and the members «hatchet men.» The organization seems to be an offshoot of the Six Companies (q.v.), though some claim that it is merely a revival of one which originated over 200 years ago in China.

HIGHER CRITICISM, The. The higher criticism is a science whose aim is the determination of the literary history of books and writings. It sets forth the facts and principles by which we must determine, in the case of any writing, its literary form, its unity, its date, the place of its composition, its authorship, the method of its composition or construction, its integrity and the amount and character of any subsequent editing it has received, so far as these matters can be discovered by the use of such internal evidence as is presented in the writing itself. It is thus the science for ascertaining the literary form and the literary history of any writing by means of internal evidence. These same matters may also be determined, in part or in whole, by external evidence in many cases; that is, by history or tradition. This latter method will not necessarily be either better or worse than the method which employs internal evidence. The greater probability of the result, in every case, will depend upon the amount and the character of the evidence which is attainable. Sometimes external evidence may be more abundant and trustworthy than the internal evidence, and sometimes the reverse may be true.

The science under consideration is termed higher criticism to distinguish it from the related science of lower, or textual, criticism. This latter science has for its object the ascertaining of the history of writings as the work of penmen and printers. It seeks to determine just the words and the letters which the author himself wrote, and what are the changes which his work has suffered in transmission. Since the literary history of a writing is, on the whole, of more importance than the history of the written or printed text, the science of the literary history is justly termed the higher criticism.

The higher criticism is a science which is equally applicable to all literatures. It may be used to determine the literary history of a writing of any age, language or people. But, of late, it has been especially brought into notice in its application to the literature of the Bible. On this account, it is sometimes spoken of as if it were a science belonging to Biblical study only. But the fact is that Biblical higher criticism is only one department of higher criticism in general.

As employed in Biblical study, higher criticism adopts the following method: (1) it sets forth the principles by which, according to the teachings of general literary criticism, we may correctly determine the literary form, the unity, the date, the place of composition, the authorship, the method of composition or construction, the integrity, the amount and character of subsequent editing, of each of the Biblical books and writings; (2) it then presents the evidential facts to be found in each of the Biblical books and writings, to which these principles will apply; and (3) finally it gives the conclusions which result from the application of these principles to the evidential facts. In practice, however, different schools of Biblical higher critics come to very different conclusions upon the same basis of evidential facts, while using the same principles of criticism. This results from the varying opinions held by these critics in relation to the value and significance of the evidential facts, due to their differing views about the history of Israel, and their philosophical convictions concerning the place of the supernatural in that history. Those critics who refuse to allow the existence of any supernatural element in the history of Israel, and hold that this history was the product of only those forces which shape and determine all human history, so that it was exactly like the history of every other people, cannot put the same value and meaning upon the historical testimony and references to be found in the Biblical books, as those critics must who believe that the history of Israel was, to no inconsiderable extent, a supernatural history, and, therefore, different from the history of every other people. In the case of the Old Testament, for example, some critics hold, because of their philosophical opinions in regard to the supernatural, and the universality of the working of the evolutionary forces of history, that the historical material of the Old Testament, as we now have it, is not to be accepted as the true basis of Old Testament history, and that this history must be constructed out of this material, under the guidance of some philosophical theory. Other critics accept the historical material which is now to be found in the Old Testament, as furnishing in itself the true Old Testament history. Since the evidential facts used in higher criticism receive their value and meaning from their evident relation to a previously determined history, it is clear that each of two so different histories cannot be a basis for the same critical conclusions. But it is to be noted that the determination of the histories is not a work of higher criticism, but is a matter which results from the philosophical opinions held by historians. The consequence of these facts is that the only results which have thus far been reached by Biblical higher criticism, which all schools of critics would accept, seem to be: (1) The existence of different documents in the Pentateuch, which have been used in its compilation, although there is, among critics, quite a little difference of view in relation to the age of these documents and the time of their compilation into the Pentateuch; (2) the plural authorship of the books of the Old Testament known as the books of Isaiah and Zechariah; and (3) the fact that older sources have been used in the making of the synoptic gospels and the book of Acts. From all that has been said, it will be seen that it is not the duty of higher criticism to assert or deny anything in relation to the inspiration of the Scriptures, or their authority for belief or conduct. With these matters this science has absolutely nothing to do.

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HIGHER LAW, a famous phrase used by William H. Seward (q.v.) 11 March 1850, in the United States Senate, on the admission of California as a State, which was held up by the Southern element to force the Congress to admit it as a slave State, or at least to divide it on the line of the Missouri Compromise (q.v.). Seward denied that the principle of compromise applied only to slavery, which was only one of many institutions, and held it equally applicable to the Territories, which were a possession to be enjoyed and administered in common by the States; and declared that the older States had no arbitrary power over them. He went on: "The Constitution regulates our stewardship; the Constitution devotes the domain to union, to justice, to defense, to welfare, to liberty. But there is a higher law than the Constitution, which regulates our authority over the domain, and devotes it to the same noble purposes. The territory is a part . . . of the common heritage of mankind, bestowed upon them by the Creator of the universe. We are his stewards, and must so discharge our trust as to secure in the highest attainable degree their happiness." And to Webster's assertion that it was absurd to re-enact the laws of God, he answered that "there is no human enactment which is just that is not a re-enactment of the law of God." It was his first set speech in the Senate, and at once made him the recognized leader of the radical section. The conservatives denounced it as treasonable, implying that no one was under any obligation to support the Constitution if he believed it in opposition to the law of God, and making the execution of any laws impossible.

HIGHER PLANE CURVES. See CURVES, HIGHER PLANE.

HIGHLAND CATTLE, a variety of small, rough-coated, usually red or black cattle, with upturned horns, kept half wild upon the moors of the Scottish Highlands, and believed to represent in part the cattle of the aboriginal Britons, which are replaced in the south of Great Britain by the short-horned breeds introduced by the Roman conquest. Compare WHITE CATTLE.

HIGHLANDERS, Scotch, in the United States. After the Jacobite risings in England in 1715 and 1745, in favor of the Old and Young Pretenders, which were zealously supported by the Highlanders (who indeed formed their backbone), the English government exerted itself to drain their strength by colonizing them elsewhere; and many who were in danger of vengeance came to America voluntarily. The chief movement was after 1745, when the government thoroughly reorganized the Highlands, broke up the clans and deported large numbers to the colonies; but after 1715 many, in bands or as individuals, had come over, especially to the Carolinas. Some settled in western South Carolina, as farmers or Indian traders; a considerable body near Fayetteville, N. C., where their descendants still speak Gaelic in preference to English, and have their church ministrations in that language; and a number of different colonies in the future Georgia, where Oglethorpe found them when he came over in 1733 with a patent for a new colony. Especially he won the hearts of a settlement at Darien, under a Captain Mackay. These Highlanders gave him priceless help in his incessant fights with the Spaniards and constant negotiations with the Indians; but they strongly opposed the slave trade or the introduction of slaves into Georgia. Some Highland companies sent to the Mohawk Valley, during the French and Indian War, were disbanded there, and remained as settlers, a recognizable element during the Indian troubles of the early Revolution.

HIGHWAY SYSTEMS AS RELATED TO SCHOOLS. See EDUCATION, RURAL.

HILARION, Saint, a hermit of Palestine, said to have been the first to introduce monasticism into Palestine: b. Tabatha, 291; d. Cyprus, 371. He studied at Alexandria, and then became a hermit under Saint Anthony. Inspired by the example of that hermit, he returned to Palestine and began to live his solitary life in a little hut in the vicinity of Majuma, the port of Gaza. He spent his days weaving baskets of rushes to keep himself alive, and practising the most vigorous asceticism. The wonders he accomplished inspired many others to emulation, and in this way the hermetical life became established in Palestine. In 356 he revisited Egypt, and with his disciple, Hesychius, lived at Sicily for a time. The story of his great piety and his power of healing so extended his popularity in the island that the crowds who flocked about him soon became unendurable, and he went further into Epidaurus in Dalmatia. He spent his last days at Cyprus, but it is said that his remains were removed to the place of his first isolation by his faithful disciple. The chief source of information concerning Saint Hilarion is the biography by Jerome based on a eulogistic letter, now disappeared, written by Epiphanus of Salamis. The facts are somewhat obscure and are difficult to establish. Saint Hilarion's day is celebrated on the 21st of October. Consult Migne (Vol. III) for the original source; and also Israel, W., 'Die Vita S. Hilaronis des Hieronymus als Quelle für die Anfänge des Mönchthums kritisch untersucht' (in *Zeitschrift für wissenschaftliche Theologie,* Jena 1880); and Zöckler, O., in 'Neue Jahrbücher für deutsche Theologie' (Vol. III, 1894).

HILARY, Saint, bishop of Poitiers: b. Poitiers, 330; d. there, 367. His parents were pagan, and by his own studies he became convinced of the truth of Christianity and accepted baptism. He became bishop of Poitiers some time before 350. His defense of the Nicene creed against the Arians resulted in his banishment to Phrygia. While there he produced his important work, 'De trinitate,' explaining his views on the subject of the trinity, chiefly for the benefit of those bishops who were inclined toward Arianism. He was released before the convocation of bishops at Seleucia, where he devoted his energy and attention to supporting the cause of the Homoiousian party against the Arians. In 361 he was sent back to his diocese, but soon found himself in great disfavor at the court because of his impeachment of Auxentius, bishop of Milan. His visit to Constantinople was the occasion for his great hatred of that monarch, which he expressed in his letter, 'Contra Constantium.' As a Latin author he was in high repute in his time. His day is 13 January. His works were published in Migne, 'Patrologia Latina' ix, x. Consult Harnack, A., 'History of Dogma' (Vol. IV, Boston 1899).

HILARY OF ARLES (HILARIUS ARELATENSIS), **Saint,** bishop of Arles: b. about 403; d. at Arles, about 450. He entered the monastery of his relative, Honoratus, bishop of Arles, and succeeded him in the office. His efforts to extend the primacy of Arles over all of southern Gaul met with opposition on the part of Pope Leo the Great, and he was deposed from his see. His day is celebrated on 5 May His extant works are preserved in Migne, 'Patrologia Latina' (Vol. I, pp. 1213–92).

HILDA, Saint, Anglo-Saxon abbess: b. about 614; d. 680. She was consecrated as a nun by Bishop Aidan, and was successively head of the abbey of Hartlepool and of the famous monastery founded by her in 657 at Whitby, Yorkshire. This continued for several centuries a religious house of great power and influence, in the time of its founder perhaps the strongest in Great Britain. Cædmon (q.v.), the Anglo-Saxon poet, was attached to the monastery during her rule and it was there that the celebrated synod took place in 664 in which the Celtic ritual was condemned. Consult Bede, 'Ecclesiastical History.'

HILDEBERT OF TOURS, French ecclesiastic and author: b. Lavardin, about 1055; d. Tours, 1133. According to tradition, he was a pupil of Berengarius and became a teacher at Le Mans, where he was made bishop in 1096. Having antagonized part of his clergy, he was taken prisoner by William II and carried off to England for a year. He was transferred in

1125 to Tours, where he was engaged in constant quarrels with other bishops and with the king of France, Louis VI. He presided over the Synod of Nantes in 1127. His works, consisting of letters, theological discussions, sermons and poems, were first published by Antoine Beaugendre (Paris 1708). Later research has proven these documents to be poorly edited since they include some spurious works. His Latin writings were extremely popular in his century. The poems were collected by Hauréau under the title 'Les mélanges poetiques d'Hildebert de Lavardin' (Paris 1882). Consult Dieudonné, L., 'Hildebert de Lavardin . . . Sa vie et ses lettres' (Paris 1898).

HILDEBRAND. See Gregory VII, Pope.

HILDEBRAND, Bruno, German economist: b. Naumburg-an-der-Saale, 1812; d. 1878. He received his education at Breslau and Leipzig universities and in 1839 was appointed professor at the former institution. Two years later he became professor at the University of Marburg. In 1846 he contributed an article to a London journal and its tone giving offense to the authorities Hildebrand was suspended from his chair. He was reinstated in 1849 and in the Frankfort Assembly sat as a member from Marburg. In 1851 he became a teacher in the Zürich High School and in 1856 was made first chief of the Swiss Bureau of Statistics at Bern. In 1861 he removed to Jena as professor at the university there and chief of the Bureau of Statistics. After 1863 he was editor of the *Jahrbücher für Nationalökonomie und Statistik*. He published 'Nationalökonomie der Gegenwart und Zukunft' (1848); 'Die kurhessische Finanzverwaltung' (1850); 'Statistische Mitteilungen über die volkswirtschaftlichen Zustände Kurhessens' (1853); 'Beiträge zur Statistik des Kantons Bern' (1860).

HILDEBRANDSLIED, an Old High German poetic fragment, written about 800 A.D. by two monks of the monastery at Fulda, on the cover pages of a Latin manuscript, now preserved at Kassel. It treats the theme, rather frequent in Aryan (Indo-European) legend, of the unequal combat between an old, and therefore stronger, father, and a younger, weaker son, with the inevitable outcome that the son (Hadubrant) is slain by his father (Hildebrant). (Consult Matthew Arnold, 'Sohrab and Rustum'). It was first printed by J. G. von Eccard in 'Commentarii de rebus Franciæ' (1729) and identified by the Grimm brothers as an alliterative recitative poem; published Kassel 1812 and Göttingen 1830; also by Eduard Sievers (Halle 1872) and in Müller's 'German Classics' (Vol. I, New York 1900). It is 68 lines long. Consult Lachmann, K., in *Philol. Abhandlungen der Berliner Akad.* (1833, pp. 123ff.); Lachmann, K., 'Kleine Schriften' (I, p. 407); Vetter, F., 'Zu Muspilli und germanischer Allitterationspoesie' (Wien 1872); Hermens, 'Über das Hildebrandslied' (Berlin 1877); Wadstein, 'Das Hildebrandslied' (Gothenburg 1903); Th. v. Grienberger, 'Das Hildebrandslied' (Wien 1908).

Jacob Wittmer Hartmann.

HILDRETH, Richard, American historian: b. Deerfield, Mass., 22 June 1807; d. Florence, Italy, 11 July 1865. He was graduated at Harvard in 1826, studied law at Newburyport, entered practice in Boston and abandoned it in 1832 to become editor of the *Boston Atlas*. In this position a series of articles by him in 1837, relative to the separation of Texas from Mexico, did much to stimulate the resistance which that movement encountered in the free States. In 1834 his anti-slavery novel, 'The Slave,' was written. This work was republished and favorably received in England and in 1852 an enlarged American edition appeared under the title of 'The White Slave: Memoir of Archy Moore' (1837). In 1837–38 he was Washington correspondent of the *Boston Atlas* and resumed his editorial post as an advocate of the election of General Harrison, of whom he wrote a campaign biography. He then abandoned journalism, and in 1840 published, under the title of 'Despotism in America,' a volume on the political, economical and social aspects of slavery, to which in the edition of 1854 was appended a chapter on the 'Legal Basis of Slavery.' In 1840–43 he resided in Demerara, British Guiana, and at Georgetown edited two free labor newspapers. Later, for several years, he was a member of the New York *Tribune* staff and in 1861 was appointed United States consul at Triest. His best-known work is his 'History of the United States' (1849–56), which extends from 1492 to the end of President Monroe's first term. The author sought an authentic presentation of the conspicuous figures of earlier American history. His work is accurate and careful, though with a Federalistic viewpoint; but so uninteresting in manner as to be ill-adapted for continuous reading. Hildreth also wrote 'Theory of Morals' (1844); 'Theory of Politics' (1853); 'Japan as it Was and Is' (1855); and 'Atrocious Judges' (1856).

HILGARD, hĭl'gärd, **Eugene Woldemar,** German-American chemist and geologist: b. Zweibrücken, Bavaria, 5 Jan. 1833; d. Berkeley, Cal., 8 Jan. 1916. He came to the United States in 1836, returned to Europe for purposes of study and was graduated (Ph. D.) at Heidelberg 1853. In 1858 he became State geologist of Mississippi, in 1873 was appointed professor of geology and natural history in the University of Michigan and in 1875 was made professor of agricultural chemistry and director of the agricultural experiment station in the University of California. He became professor emeritus in 1909. He received the Liebig medal from the Munich Academy of Sciences in 1894, and his investigations into the chemistry and physics of soils have done much to promote agricultural science. He was a member of the Northern Transcontinental Survey which in 1880–83 studied the agricultural possibilities of Montana, Oregon and Washington. Much of his work was published in the bulletins of the California Agricultural Experiment Station. He published 'Report on the Geology and Agriculture of Mississippi' (1860); 'Report on the Agricultural Features of the Pacific Slope' (1882); 'Memoir on the Rock-Salt Deposit of Petite Anse, La.' (1872); 'Soils of the Arid and Humid Regions' (1906); 'Agriculture for Schools of the Pacific Slope,' with W. J. V. Osterhout (1909).

HILL, Ambrose Powell, American military officer: b. Culpeper County, Va., 9 Nov. 1825; d. 2 April 1865. He was graduated at the United States Military Academy 1847; served in the Mexican War, but resigned from the army in March 1861, and was made colonel of the 13th Virginia regiment of the Confederate army. Having distinguished himself in service, he was promoted major-general in May 1862, and lieutenant-general 20 May 1863, and placed in command of one of the three corps of the Army of Northern Virginia. He led his corps at Gettysburg and later at Bristow Station and the assault on the Weldon Railroad in 1864. He was killed in the attack on Petersburg, Va.

HILL, Benjamin Harvey, American legislator; b. Jasper County, Ga., 14 Sept. 1823; d. 16 Aug. 1882. He was graduated at the State University of Georgia in 1844 and chose law as a career. In 1851 he was elected to the State legislature. He in vain attempted to withstand the secession sentiment of his State, but at last yielded to the movement, and was elected to the Provisional Confederate Congress, and from the assembly promoted to the Confederate Senate. He supported Greeley for the Presidency in 1872, and was defeated for the United States Senate the following year, but after being elected to the House of Representatives in 1875 was given a seat in the United States Senate 1876 and held it for the remainder of his life.

HILL, Daniel Harvey, American military officer; b. Hill's Iron Works, York District, S. C., 12 July 1821; d. Charlotte, N. C., 24 Sept. 1889. He was graduated at the United States Military Academy in 1842, and served in the Mexican War; became professor of mathematics and military tactics in Washington College, Va., in 1849, professor of mathematics in Davidson College, N. C., in 1854; and was made president of the North Carolina Military Institute in Charlotte in 1859. At the outbreak of the Civil War he entered the Confederate army as colonel; was promoted to lieutenant-general in 1863, and commanded a corps at the battle of Chickamauga. After the close of the war he resumed his educational work, and in 1877 became president of the Arkansas Industrial University, where he remained until shortly before his death.

HILL, David Bennett, American lawyer and politician: b. Havana, N. Y., 29 Aug. 1843; d. 20 Oct. 1910. He entered a law office in Elmira, N. Y., in 1862, and after admission to the bar in 1864 rapidly built up a law practice and was an acknowledged leader of the local bar. He was active in politics, and acquired a leadership there also, through his genius for organization. He was a member of the State assembly 1870–71, and president of the Democratic State Convention in 1877 and 1881. In 1882 he was elected mayor of Elmira and lieutenant-governor in the same year, with Cleveland as governor. In 1885, when Cleveland resigned to take up his duties as president, Hill became governor. He was subsequently twice elected governor, serving till January 1892, when he took his seat in the United States Senate. During his first administration as governor, the legislature was Republican and he was involved in a number of partisan struggles. As senator, he opposed on some issues the policy of President Cleveland; he was also opposed to the income tax clause of the Wilson Tariff Bill. In 1892 he was a prominent candidate for the presidency at the Democratic National Convention and at the convention of 1896 was one of the chief leaders of those who favored the gold standard and were opposed to radicalism in the party. In 1894 he was again candidate for governor of New York State, but was defeated by Levi P. Morton. In 1902 he practically dominated the Democratic State Convention and was active throughout the campaign.

HILL, David Jayne, American educator and diplomat: b. Plainfield, N. J., 10 June 1850. He was educated at Bucknell University, where he became professor of rhetoric 1877–79, and president 1879–88. He was president of Rochester University, New York, 1888–96, resigning to spend three years in Europe studying international law and diplomacy. He was First Assistant Secretary of State 1898–1903; Minister to Switzerland 1903–05, to the Netherlands 1905–08 and from 1908–11 to Germany. In 1914 he was an unsuccessful candidate for the United States Senate from New York to succeed Elihu Root. He is a member of the Permanent Administrative Council of The Hague Tribunal and was delegate to the Second Peace Conference at The Hague. He has written biographies of ‘Washington Irving’ (1879); ‘William Cullen Bryant’ (1879); ‘Principles and Fallacies of Socialism’ (1885); ‘International Justice’; ‘A Premier of Finance’; ‘Genetic Philosophy’ (1893); ‘The Life and Work of Hugo Grotius’ (1902); ‘The Conception and Realization of Neutrality’ (1902); ‘A History of Diplomacy in the International Development of Europe’ (1905), of which three volumes of six have appeared; ‘World Organization as Affected by the Nature of the Modern State’ (1911; French and German translations); ‘The People's Government’ (1915); ‘The Rebuilding of Europe’ (1917).

HILL, Frank Alpine, American educator: b. Biddeford, Me., 12 Oct. 1841; d. Brookline, Mass., 12 Sept. 1903. He had been long prominent among New England educators, and after being head-master of high schools in Milford, Chelsea and Cambridge, Mass., became secretary of the Massachusetts State Board of Education in 1894. He was a trustee of the Massachusetts Institute of Technology, of the State Agricultural College at Amherst and of the Boston Museum of Fine Arts, as well as a commissioner of the State School Fund.

HILL, Frank Pierce, American librarian: b. Concord, N. H., 22 Aug. 1855. He was graduated from Dartmouth in 1876 and received the degree of LL.D., 1906. In 1881 he became librarian of the Lowell public library, and in 1885 he organized the first free public library in New Jersey at Paterson. He also organized the Salem public library and the Newark library in 1889. At Newark a new building was erected under his administration and the library brought to a high degree of efficiency so that it is recognized as one of the model public libraries. In 1901 he was appointed chief librarian of Brooklyn and under his administration the library has grown from a system of 18 branches with an annual circulation of 944,128 to a system of 31 branches and 13 stations with an annual circulation of 5,875,190 and now ranks as the second largest public library in the United States. During this period 20 buildings were erected under the gift of Mr. Carnegie and plans made for a magnificent central library building which will cost approximately $5,000,000. He was secretary American Library Association 1891–95 and president in 1906.

HILL, Frederic Stanhope, American sailor and author: b. Boston, 24 Aug. 1829. He went to sea when a boy, and during the Civil War was an officer in the United States navy. He was with Farragut at the capture of New Orleans and Vicksburg, and was also in command on the Texas coast and in the Mississippi squadron. He has written ‘Twenty Years at Sea’ (1896); ‘Story of the Lucky Little Enterprise’; ‘Twenty-six Historic Ships’ (1903); and has been editor of the Cambridge *Tribune*.

HILL, George Birkbeck, English educator and author: b. Tottenham, Middlesex, 7 June 1835; d. Hampstead, London, 27 Feb. 1903. He was a nephew of Sir Rowland Hill (q.v.), was educated at Oxford, and was head-master of Bruce Castle School 1859–76. Since the latter date he had devoted his attention to literature, especially to the literary history of the 18th century. He was an authority on Dr. Johnson and his contemporaries. He was well known in the United States through his ‘Harvard College, by an Oxonian’ (1894). Other works by him are ‘Talks about Autographs’ (1896); ‘Dr. Johnson: his Friends and his Critics’ (1878); ‘Life of Sir Rowland Hill’ (1880); edited Boswell's ‘Life of Johnson’ (1881–87); ‘Footsteps of Dr. Johnson in Scotland’ (1890); ‘Memoirs of the Life of Edward Gibbon’ (1900); ‘Letters of Dante Gabriel Rossetti’ (1897); ‘Letters written by a Grandfather’ (1903); and, posthumously, a volume of ‘Letters’ (1907).

HILL, James Jerome, American railroad promoter and financier: b. near Guelph, Wellington County, Ontario, Canada, 16 Sept. 1838, of Scotch-Irish parentage; d. Saint Paul, Minn., 29 May 1916. Until his father's death, when the boy was in his 15th year, he attended a neighboring academy. After that he was employed in a country store, until in search of larger opportunities he reached Saint Paul, Minn., in 1856, after visiting different parts of the country. As clerk or agent he was employed in the Mississippi River steamboat business for the next 12 years; and in 1870 established the Red River Transportation Company. This gave service between Saint Paul and Winnipeg, and through it Mr. Hill obtained an idea of the immense coming importance of transportation in the Northwest. In 1878, a syndicate of four men, of whom Mr. Hill was one, bought the defaulted bonds of the Saint Paul and Pacific Railroad Company. It had been in the receiver's hands since 1873 and Mr. Hill was one of the few men who believed in its future. In 1879 this property was organized as the Saint Paul, Minneapolis and Manitoba Railway Company and was completed and rapidly extended westward. Mr. Hill was general manager, became vice-president in 1881 and president in 1882. The latter office he held for 25 years. This enterprise contemplated, from an early date, the extension of the line to the Pacific Coast. This was built, through a difficult and unsettled country, by private financing, without the government's assistance. The road was completed to Seattle, on Puget Sound, in 1893. Between 1881 and 1883 Mr. Hill was interested with other capitalists in building the Canadian Pacific line. His energy and interest were, however, concentrated upon the rounding out and perfecting of his own system. It was extended to Duluth and connected with steamships owned by the railroad and operating on the Great Lakes. By 1890 all the lines of the system were united in the Great Northern Company. Steamships were built to run from Puget Sound ports to Japan and China. Some lands containing iron ore had been bought by Mr. Hill, as a private citizen, in 1889. The ore deposits, being large and valuable, were turned over to a company formed to hold them with others purchased later. The entire property was distributed later among holders of Great Northern stock. The Great Northern and the Northern Pacific together purchased, in 1901, the Chicago, Burlington and Quincy Railroad Company. Together they also built the Spokane, Portland and Seattle line along the north bank of the Columbia River. Connections of the Great Northern thus gave it access to all important markets and ports in the country. Mr. Hill resigned as president in 1907, to become chairman of the board of directors. He was succeeded in his former office by his son, L. W. Hill. From 1912, when he resigned the chairmanship, he held no official place in the company. Both personally and financially he was as closely identified as ever with the great property that was so largely his own creation. Among the diverse interests of Mr. Hill's life, other than railroad work, was agricultural improvement, which he instigated and assisted throughout the Northwest. From the beginning the prosperity of the farm and the prosperity of the railroad were identical to his mind. In addition to that, he believed that the chief interest everywhere rests finally on the foundation of the farm. He gave much of the study and efforts of his best years to ascertaining methods of raising and maintaining soil fertility, and of increasing the quality and quantity of the acre product. His opinion was widely sought on many subjects; and he took a lively interest in art, literature and economic and civic questions. Consult Pyle, Joseph Gilpin, ‘The Life of James J. Hill’ (2 vols., New York 1917).

HILL, Octavia, English housing and social reformer: b. about 1838; d. 13 Aug. 1912. She began work among the London poor under F. D. Maurice (q.v.); and in 1864, supported by Ruskin, began her great work of improving the homes of workingmen in the slums of London. Her methods were based upon the principle of teaching the people to help themselves, by inculcating in them right notions of cleanliness, order and self-respect. Her efforts were crowned with success; the houses which were improved yielded a good percentage on the money spent in effecting the improvements; and through her hundreds have been helped to lead more comfortable and better lives. She was a member of the Poor Law Commission of 1905, and was the author of ‘Homes of the London Poor’ (1875); ‘Our Common Land and other Essays’ (1878). Consult her ‘Life as told in Her Letters’ (1913).

HILL, Robert Thomas, American geologist: b. Nashville, Tenn., 11 Aug. 1858. He was graduated from Cornell University in 1866 and was immediately given a position on the United States Geological Survey. He was also a lecturer in the school of economics at the University of Michigan, and professor of geology at the University of Texas for two years, which position he resigned to return to the United States Geological Survey. He has been engaged in geological and geographical explorations in the Southwestern States, Mexico, Central America and the West Indies. His work in the two last-mentioned localities has been the investigation of the origin of the land forms, and the problem of the union of the continents. Among his most valuable contributions to geological science have been the proof of the existence of the lower cretaceous formation in the United States and the announcement of the possibility of artesian wells in Texas. In May 1902 he was sent by the National Geographical Society at the head of the expedition to investigate the volcanic eruption of Mount Pelée in Martinique. His publications include 'On Occurrence of Artesian and Other Underground Waters in Texas, Eastern New Mexico, and Indian Territory' (1892); 'Cuba and Porto Rico with other Islands of the West Indies' (1898); and numerous contributions to the bulletins of the Geological Survey and periodicals.

HILL, Rowland, English popular preacher: b. Hawkstone, Shropshire, 23 Aug. 1744; d. London, 11 April 1833. He was ordained in the Anglican Church, but embracing the views of the Calvanistic Methodists, soon began to preach in barns and meeting-houses, and when they were too small or too distant, or not to be procured, in streets, fields and highways. In 1783 he laid the foundation of Surrey Chapel, Blackfriars road, London, where he preached with great success every winter for about 50 years, making summer excursions to the provinces, where his eloquent but eccentric preaching attracted immense crowds. He played a conspicuous part in the religious and philanthropic activities of his time. He published sermons and other theological works, of which the best known are his 'Village Dialogues.' Consult his 'Life' by Sidney (1833); and by Jones (1834).

HILL, Rowland, 1st Viscount, English soldier, nephew of Rev. Rowland Hill (q.v.): b. Prees, Shropshire, 11 Aug. 1772; d. near Shrewsbury, England, 10 Dec. 1842. He entered the army in 1790 and served with distinction in the campaigns from Toulon to Waterloo. In 1812 he was made a K.B., and in 1814 was created Baron Hill. At the battle of Waterloo, Lord Hill commanded the right wing of the British. In 1828 he was appointed general commanding-in-chief of the British army. This important office he continued to hold under several successive ministries, and only resigned it a few months before his death. He was made a viscount in 1842. He was often styled "the right arm of Wellington." Consult Sidney's 'Life of Lord Hill' (1845).

HILL, Sir Rowland, English postal reformer: b. Kidderminster, 3 Dec. 1795; d. 27 Aug. 1879. He conducted a school near Birmingham in his earlier years on what was known as the Hazelwood method, from the name of the school, the feature of which was a system of self-government by the boys themselves. In 1833 he abandoned this work, and shortly after this he was appointed secretary to the commissioners for the colonization of South Australia. He began to interest himself in postal matters, and was amazed to find that in the face of enormously expanding trade, under a high tariff of charges post office receipts were declining, whereas in France, with low rates, they were rapidly increasing. In 1837 he published a pamphlet recommending the adoption of a low and uniform rate of postage throughout Great Britain and Ireland. The scheme was approved by a committee of the House of Commons, and early in 1840 the penny postage system was carried into effect with the assistance of Rowland Hill, who, for this purpose, received an appointment in the Treasury. He applied himself to the work, and in spite of the obstruction of officialdom soon proved the merits of his system. In 1846 he received a public testimonial of the value of upward of £13,000. In 1846, he was made secretary to the Postmaster-General, and in 1854 chief secretary to the Post-office. In 1860 he became K.C.B. Consult his 'Life' and 'History of Penny Postage' (2 vols., 1880); Smyth, 'Sir Rowland Hill: the Story of a Great Reform' (1907).

HILL, Thomas, American Unitarian clergyman and mathematician: b. New Brunswick, N. J., 7 Jan. 1818; d. Waltham, Mass., 21 Nov. 1891. Left an orphan at 10 years; at 12 he was apprenticed to the printer of the *Fredonian* newspaper, where he remained four years. He then entered an apothecary's shop, after a year's attendance at school, and served in it several years. He was graduated from Harvard College in 1843; and from the divinity school in 1845, and was settled as pastor at Waltham the same year. He was president of Antioch College, Ohio, 1859–62. He accompanied Agassiz on his expedition to South America and was pastor of the Unitarian church at Portland, Me., 1873–91. He published 'Elementary Treatise on Arithmetic' (1845); 'Geometry and Faith' (1849); 'First Lessons in Geometry' (1855); 'Treatise on Curves' (1855); 'The Natural Sources of Theology' (1875); 'In the Woods and Elsewhere,' verse (1888), etc.

HILL, Thomas, American painter: b. Birmingham, England, 11 Sept. 1829; d. 1908. He came to the United States in 1841. Returning to Europe he studied under Paul Meyerheim for several months, but was practically a self-taught artist. He painted the 'Yosemite Valley' which was chromo-lithographed by Prang. He continued to confine himself to the grander aspects of American scenery, and notable among his productions are 'The Home of the Eagle'; and 'Grand Cañon of the Sierras'; 'White Mountain Notch'; 'Donner Lake'; 'Muir Glacier.' He spent most of his life after 1860 in San Francisco.

HILL, Walter Barnard, American lawyer and educator: b. Talbotton, Ga., 9 Sept. 1851; d. Athens, Ga., 28 Dec. 1905. He was graduated from the University of Georgia in 1870, and from the law school in 1871, with the degree of A.M. He was admitted to the bar, and practised law in Macon, Ga., from 1871 to 1899. He was a member of the Georgia Bar Association, and was its president in 1888; a member also of the American Bar Association and the chairman of the committee on judicial administration. He also was actively interested in educational progress, being trustee of Vanderbilt University at Nashville, Tenn. In 1899 he was appointed chancellor of the University of Georgia; as an educator he strongly approved the work of the Tuskegee and similar institutions for the negro. He wrote articles on legal and educational subjects and compiled the Law Code of Georgia (1873, 1882).

HILL RIVER. See Hayes River.

HILLARD, hil'ard, **George Stillman,** American author and lawyer: b. Machias, Me., 22 Sept. 1808; d. Boston, 21 Jan. 1879. He was graduated from Harvard in 1828, and from the Harvard Law School four years later. He was a member of the Massachusetts senate in 1850, where his policy as a legislator was warmly commended by Daniel Webster; a member of the Massachusetts Constitutional Convention in 1853; and United States district attorney in 1866–70. Though successful as a lawyer his tastes were largely literary; he was well known as a lecturer; was editor of the *Christian Register* with George Ripley, and associate editor of the Boston *Courier;* wrote 'Six Months in Italy' (1853); 'Life of George Ticknor' (with Mrs. Ticknor); 'Life of George B. McClellan' (1864), and edited a series of school readers which bore his name, and the works of Spenser.

HILLEBRAND, Karl, German critic and historian: b. Giessen, 17 Sept. 1829; d. Florence, 19 Oct. 1884. For participation in the insurrection in Baden (1849) he was imprisoned, but escaped to France, where he was graduated at the Sorbonne, and in 1863 became professor of foreign languages at Douai. On the outbreak of the Franco-Prussian War, he removed to Italy and passed the remainder of his life there. He was a remarkable linguist, writing valuable books in French, German, Italian and English. Among these are 'Geschichte Frankreichs v. d. Thonbesteigung Ludwing Philipps biz zum Fall Napoleon III' (1848); 'Des Conditions de la Bonne Comedie' (1863); 'La Prusse Contemporanie' (1867); 'Public Instruction in the United States' (1869); 'Lectures on German Thought during the Last Two Hundred Years' (1880). Consult Homberger, 'Karl Hillebrand' (1884).

HILLEGAS, Howard Clemens, American journalist and author: b. Pennsburg, Pa., 30 Dec. 1872. He was graduated from Franklin and Marshall College, Lancaster, Pa., in 1894, and after being connected with several Pennsylvania journals was war correspondent of the New York *World* in South Africa 1899–1900. He has published 'Oom Paul's People' (1899); 'The Boers in War' (1900); 'With the Boer Forces' (1900).

HILLEL, Jewish rabbi, who flourished in the time of Herod. He was commonly called Ha-zaken, the elder, to distinguish him from others bearing the same name. Descended from an ancient family of Babylonia, he left his home to study law at Jerusalem. In order to earn a livelihood, he hired out as a day laborer, meanwhile studying diligently; and became an important authority on Jewish teaching and law. He was distinguished for the liberality of his thought and his interpretations of the Scriptures and rabbinical teachings. Many fine sayings were attributed to him. He was president of the Sanhedrin for many years. By several modern writers, notably Renan, Hillel's influence on Jesus is given great weight. Consult Renan, 'Vie de Jésus' (Paris 1863); Geiger, A., 'Das Judenthum und seine Geschichte' (Breslau 1865); Stapfer, E., 'Les Idées religieuses en Palestine à l'époque de Jésus Christ' (Paris 1878).

HILLERN, Wilhelmine von, German authoress: b. Munich, 11 March 1836. She is the daughter of a well-known novelist, Charlotte Birch-Pfeiffer. She was brought up in Berlin, became an actress at Gotha (1854), and married the prominent jurist von Hillern at Freiburg in Breisgau in 1857. Her husband died 8 Dec. 1882. She has since been living chiefly at Oberammergau and Tutzing. Her principal novels and short stories were produced during the 60's and 70's of the last century. One of them, 'Höher als die Kirche' (1877) is quite well known in America by reason of the fact that it is frequently read as a text by students of elementary German. It is a comparatively insignificant work, however, by no means so important as the novels, 'Ein Arzt der Seele' (Berlin 1869), 'Die Geyer-Wally' (Berlin 1875) and 'Und sie kommt doch' (Berlin 1879).

HILLHOUSE, James, American politician: b. Montville, 21 Oct. 1754; d. New Haven, Conn., 29 Dec. 1832. He was graduated in 1773 at Yale, of which institution he was treasurer from 1782. He studied law, and took an active part in the struggle of the Revolution; was a Federalist member of Congress in 1791, and in 1795–1810 a member of the United States Senate. He was also a member of the Hartford Convention of 1815. It was chiefly through his initiative in the planting of trees that New Haven came to obtain the title of "Elm City."

HILLHOUSE, James Abraham, American poet: b. New Haven, Conn., 26 Sept. 1789; d. near there, 4 Jan. 1841. He was the son of James Hillhouse (q.v.). He was graduated at Yale College in 1808, entered commerce in New York and published in London his drama of 'Percy's Masque,' reprinted in New York with changes in 1820. In 1822 he removed to a country seat near New Haven, where he passed the remainder of his life. In 1825 he published his second drama, 'Hadad'; and in 1839 a collected edition of his writings appeared under the title of 'Dramas, Discourses, and other Pieces.' His dramatic writings, once greatly praised, now appear grandiose and dull.

HILLIARD, hil'yard, **Henry Washington,** American lawyer: b. Fayetteville, N. C., 4 Aug. 1808; d. Atlanta, Ga., 17 Dec. 1892. He was graduated at South Carolina College in 1826, was admitted to the bar in 1829, in 1831–34 was a professor in the University of Alabama (Tuscaloosa), in 1838 was chosen to the Alabama legislature, in 1842–44 was United States charge-d'affaires in Belgium, and in 1845–51 represented an Alabama district in Congress. Though opposed to secession, he became a brigadier-general in the Confederate army. He was United States Minister to Brazil, in 1877–81. He wrote 'Speeches and Addresses' (1855); 'De Vane, a

Story of Plebeians and Patricians› (1865); and ‹Politics and Pen Pictures› (1892).

HILLIS, hĭl'ĭs, **Newell Dwight,** American Presbyterian clergyman: b. Magnolia, Iowa, 2 Sept. 1858. He was educated at Iowa College and Lake Forest University, studied theology at McCormick Theological Seminary, entered the ministry of the Presbyterian Church, and held pastorates at Peoria, Ill. (1887–90), and Evanston, Ill. (1890–94). In 1894 he was appointed pastor of the Central Church, Chicago, an independent congregation, and in 1899 of Plymouth Church of Brooklyn. He became known also as lecturer and has published ‹The Investment of Influence›; ‹A Man's Value to Society›; ‹How the Inner Light Failed›; ‹Foretokens of Immorality›; ‹Great Books as Life Teachers›; ‹The Influence of Christ in Modern Life›; ‹The Quest of John Chapman› (1904); ‹The Quest of Happiness› (1902); ‹Success Through Self-Help› (1903); ‹The Fortune of the Republic› (1906); ‹Contagion of Character› (1911); ‹Anti-Slavery Epoch› (1911); ‹Prophets of a New Era› (1912); ‹Story of Phædrus› (1913); ‹Lectures and Orations of Henry Ward Beecher› (1913); ‹Message of David Irving› (1913); ‹Studies of the Great War› (1915).

HILLSBORO, Ill., city, county-seat of Montgomery County, on the Cleveland, Cincinnati, Chicago and Saint Louis and the Chicago and Eastern Illinois railroads, about 45 miles south by west of Springfield and 52 miles northwest of East Saint Louis. Its chief manufactures are flour, furniture, glass jars, woolen goods, carriages and wagons and dairy products. There is a coal-mine nearby and there are zinc and lead smelters, a condensed milk plant and a brickyard. It is the commercial centre of an agricultural section of the State. The waterworks are municipally owned. The commission form of government was adopted in 1911. Pop. 3,424.

HILLSBORO, Ohio, village, county-seat of Highland County, on the Norfolk and Western and the Baltimore and Ohio Southwestern railroads, about 60 miles southwest of Columbus and 50 miles east by north of Cincinnati. It is in an agricultural and stock-raising region. The chief manufactures are furniture, foundry products, flour, lumber, safes and vaults, chairs, overalls, dairy products and cigars. It is the trade centre for a large part of Highland County. It has a public library containing about 8,000 volumes, and a number of fine public and private buildings. The city owns and operates the waterworks. Pop. 4,296.

HILLSBORO, Tex., city, county-seat of Hill County, on the Missouri, Kansas and Texas and the Saint Louis Southwestern railroads, about 52 miles southwest of Dallas and 38 miles north of Waco. It is situated in an agricultural and stock-raising region. Its chief manufactures are cottonseed oil, cotton goods, advertising novelties, hosiery, flour, candy, men's clothing, agricultural implements and lumber. The trade is largely in live stock, cotton, hides, grain, hay and lumber. It has a creamery, cotton-gins, cotton-compresses, planing-mills and hay presses. The government is administered by a mayor and four aldermen. The city owns and operates the waterworks and sewage system. Pop. 6,115.

HILLSDALE, Mich., city, county-seat of Hillsdale County, on the Lake Shore and Michigan Southern Railroad, about 88 miles southwest of Detroit and 60 miles west of Toledo, Ohio. The first permanent settlement was made about the year 1840. It is situated in a rich agricultural region in which are raised large quantities of fruit. The chief manufactures are flour, fur garments, screens for doors and windows, wagon-wheels, tables, furnaces, furniture, condensed milk and canned fruits. The trade, in addition to the manufactures, is chiefly in grain, fruits, vegetables and livestock. Baw Beese Park, outside the city limits, is owned by the city and is a popular summer resort. Hillsdale is the seat of Hillsdale College (q.v.). The electric-light plant and the waterworks are owned and operated by the city. The government is vested in a mayor, elected for one year, and a council. Pop. 5,001.

HILLSDALE COLLEGE, a coeducational institution founded in 1855 under the auspices of the Free Baptist Church, in Hillsdale, Mich. Since its establishment it has graduated about 1,300 students. The number of professors and instructors in 1916 was 24, the number of students 457. Special attention is given to the classical and scientific work, but the modern languages are not neglected. Departments of fine arts, music, elocution, home economics, business are flourishing.

HILL-TIT, a small, soft-billed, tit-like bird (*Liothrix luteus*) of the Orient, common as a cagebird, and known to dealers as Japanese robin, Pekin robin and Chinese nightingale. Its native home is the Himalayas and eastward into southwest China. It is about the size of the house sparrow. Its colors are rich. The upper parts are olive-green, with a yellow forehead, ring around the eye, and wing-patch. The secondary wing quills are bluish-black. The throat is rich yellow, fading to whitish on the abdomen. Bill red. The male has a brilliant song. This bird is hardy, but requires soft food.

HILO, hē'lō, Hawaii, town on Hilo Bay, on the eastern coast of the island, about 38 miles from Mauna Loa, 36 miles from Mauna Kea (the highest peak of the group) and 28 miles from Kilauea. Hilo is the second town in size in the Hawaiian Islands. It has the best harbor belonging to the group. The lighthouse in the harbor can be seen many miles. Large lava-fields are near; on the northwest side of the town and in the vicinity are extensive forests. The craters of Loa and Kilauea, the largest in the world, are visited annually over delightful drives by many tourists who land at Hilo. The inhabitants of the town include many races; but people from the United States who have engaged in business in Hilo are quite prominent. The town has a library, custom house and a courthouse. Hilo has good schools to which attendance is compulsory. The population of the town, which is co-extensive with the district of the same name, is 21,992.

HILONGOS, hē-lŏng'ōs, Philippines, pueblo of Leyte, on the southwest coast at the mouth of the Salog River, 62 miles southwest of Tacloban. It has a good harbor. Pop. 13,813.

HILPRECHT, Herman Volrath, hĕr'män fōl'rät hĭl'prĕʜt, **American Assyriologist:**

b. Hohenerxleben, Germany, 28 July 1859. He was graduated at Leipzig in 1883 and was curator of the Semitic section of the museum of the University of Pennsylvania, to which he presented the greater part of the 27,000 original cuniform inscriptions which it contains. He was made professor of Assyrian and comparative Semitic philology in the same institution 1886–1911. In 1888–89 he was Assyriologist and scientific director of the University of Pennsylvania's expedition to Nippur, Babylonia, and editor-in-chief of its publications. In 1882 he studied the Assyrian inscriptions in the British Museum, traveled in Asia Minor and Syria and became an authority on cuneiform inscriptions. He reorganized the Babylonian department of the Imperial Ottoman Museum in Constantinople in 1893–1909. He also made trips to Ceylon, India, China, Japan and Korea 1911–12. Among his works may be mentioned ‘Old Babylonian Inscriptions, chiefly from Nippur’; ‘History of the Babylonian Expedition of the University of Pennsylvania to Nippur’; ‘Recent Researches in Bible Lands’; ‘Explorations in Bible Lands during the 19th Century’ (1903); ‘Ausgrabungen in Assyrien und Babylonien’ (1904); ‘The So-called Peters-Hilprecht Controversy’ (1908); The Oldest Version of the Babylonian Deluge Story’ (1910), and numerous contributions to scientific journals.

HILSA, the common shad of India and Burmah (*Clupea Palasa*) which in spring and summer migrates from the sea to the heads of the rivers to spawn in the shallows. The main body of these fishes ascends the river when the June monsoon begins; but their appearance in particular rivers is often long delayed, and varies with the rapidity of the current and what are regarded as inherited local habits and instinct. This widespread and valuable fish has many names; thus it is «pulla» in the Indus Valley; «sable-fish» in Bengal and «palasah» among the Telingis, and is called «nga-tha-louk» by the Burmese.

HILTON HEAD, an island, at the mouth of the Broad River, off the southeast coast of South Carolina; a part of Beaufort County. Fort Walker, a Confederate fortification, was erected here during the Civil War. On 5 Nov. 1861, the fort was attacked by a Union fleet, under Commodore Dupont; Commodore Tatnall, with a Confederate flotilla, or «mosquito fleet,» assisted Fort Walker, but it was captured by Dupont. The reports gave Union loss 8 killed and 23 wounded; Confederates, 10 killed and 10 wounded.

HIMALAYA, hĭm-ä'lä-yạ or hĭm-ạ-lä'yạ (from the Sanskrit signifying the abode of snow), a mountain system of Asia lying along the northern frontier of British India. It contains the highest peaks in the world, the principal mass of which is near the southern edge of the central section of the continent between long. 65° and 110° E., and lat. 28° and 37° N. The system extends approximately from northwest to southeast for about 2,000 miles, while its breadth varies from 100 to between 500 and 600 miles. The elevated plateau of Tibet, between the Himalaya proper and its extension, the Kuen-Lun Range, is the widest part of the system. While the term Himalaya is usually confined to the range forming the northern barrier of India, the Hindu-Kush, on the northwest, and the Karakoram with the Kuen-Lun to the north are not distinct chains as frequently represented, but are all portions of the same connected mountain mass, having very little to distinguish them from the rest of the elevated system to which they belong. The Himalaya is connected on the east with the mountains of China and the Indo-Chinese Peninsula, and on the west with the mountains of Baluchistan and Afghanistan. The Pamir Plateau, described as a «huge boss or knot» north of the Hindu-Kush, connects the Himalayas with the Thian-Shan, another mountain system which extends northeastward for about 1,200 miles. From the Ganges-watered plain of northern India, which has an elevation of about 1,000 feet above the sea, the Himalayas ascend by successive slopes. The transition from this plain to the ascent of the range is marked in the northwest by a belt of dry, porous ground, broken up into numerous ravines. East of this is the «Terai,» a belt of sloping marshland covered with forest and jungle, very malarious and crowded with wild animals. Beyond this lies the «Bhabar,» a belt of gravelly and sandy nature covered with forests of valuable timber trees. The «duns,» «maris» or «dwars,» longitudinal valleys partly cultivated and partly yielding forest growth, occupy the space between the Bhabar and the slopes of the Himalayas. The principal passes are the highest in the world and include the Ibi-Gamin pass in Garwhal 20,457 feet, the Mustagh 19,019 feet, the Parangla 18,500 feet, and the highest on which traffic passes, the Kronbrung 18,313 feet and the Dura Ghat 17,750 feet. The greatest elevations of the Himalayan system are Mount Godwin-Austen 28,278 feet in the Karakoram range, and in the Himalayas proper, Mount Everest 29,002 feet, the highest peak in the world, Kunchinjinga 28,146 feet and Dhawalagiri 26,826 feet. On the north the limit of the snow line is 17,400 feet, on the south 15,000 to 16,000 feet. From the southern slope of the central portion of the great chain flow the various streams which unite in the Ganges; from the southern slope of the northwestern portion spring the rivers of the Punjab or «Five Waters,» which unite to swell the Indus which rises on the northern slope and flows southwestward to the Arabian Sea; also on the northern slope not far from the source of the Indus springs the Brahmaputra which flows east, southwest and south to the Bay of Bengal; and also from the plateau of Tibet north of the main Himalayan range flow the Salwin, Mekong and other rivers of the Indo-Chinese Peninsula, the Yangtse, Hwang-ho and other rivers of the Chinese Empire. The whole system is of granitic formation associated with gneiss and mica-slate, followed in descending by metamorphic and secondary rocks, until the alluvial deposits are reached. Minerals abound; copper and lead have been mined from ancient times, iron more recently, coal is found at the foot of the mountains, gold in the beds of the mountain torrents, zinc, sulphur, plumbago and salt are also obtained, and there are numerous mineral springs. The vegetation is luxuriant; rhododendrons are in rich profusion, and there are forests of pine, spruce, silver-fir and deodar cedar at varying altitudes. Consult Freshfield, Douglas, ‘Round Karchenjunga' (1903); Wadddll, 'Among the Himalayas'; Workman, 'In the Ice World of Himalaya' (1900); 'Call of the Snowy Hispar' (1907); 'Icebound Heights of the Mustagh' (1908).

HINCKLEY, Thomas, American colonial governor: b. England, about 1618; d. Barnstable, Mass., 25 April 1706. In 1635 he emigrated to America, and settled in Scituate, but four years later removed to Barnstable. He was deputy governor of Plymouth Colony in 1680 and afterward governor.

HINCKS, Sir Francis, Canadian statesman: b. Cork, Ireland, 14 Dec. 1807; d. Montreal, 18 Aug. 1885. He went to Canada in 1831, set up in business at Toronto, and founded in 1838 the *Examiner.* In 1841 he entered the first United Parliament as a Liberal. He first entered the cabinet in 1841 as Inspector-General of Accounts. He undertook the editorship of *Pilot,* Montreal in 1844. From 1851 to 1854 he held the premiership, during which time he passed many important measures. He showed great activity in railway development, and passed the Municipal Loan Fund Act designed to pledge local credit for railway construction; concluded, with Lord Elgin, a treaty of reciprocity with the United States; and was instrumental in introducing the decimal system of coinage. In 1854 his ministry suffered defeat on the clergy reserves question. From 1855–62 he was governor of Barbadoes, from 1862–69, of British Guiana, Minister of Finance 1869–73, and from 1873 editor of the Montreal *Journal of Commerce.* He was created K.C.M.G. in 1869, and was one of the Ontario boundary commissioners in 1878. Among his publications are 'Canada: Its Financial Position and Resources' (1849); 'The Political History of Canada between 1840 and 1855' (1877).

HIND, hind, John Russell, English astronomer: b. Nottingham, 12 May 1823; d. Twickenham, 23 Dec. 1895. In 1840 he obtained a situation in the Royal Observatory at Greenwich. He was a member of the commission appointed to determine the exact longitude of Valencia (1844), and on his return was appointed the observer in Bishop's Observatory, Regent's Park. There he calculated the orbits of more than 70 planets and comets, noted several new variable stars and nebulæ and discovered 10 minor planets. In 1851 he obtained from the Academy of Sciences at Paris the Lalande medal, and was elected a corresponding member; and in 1852 received the Astronomical Society of London's gold medal, and a pension of $1,000 a year from the British government. In 1857–91 he was director of the 'Nautical Almanac,' and in 1880 president of the Royal Astronomical Society. He wrote 'The Solar System' (1846); 'Astronomical Vocabulary' (1852); 'The Comets' (1852); 'Elements of Algebra' (1885); 'Introduction to Astronomy' (1871), and other works.

HIND AND THE PANTHER, The, by Dryden (1687), is an elaborate piece of theological controversy and satire in heroic couplets. The poet, recently converted to Catholicism, represents his new faith as the milk-white immortal hind, the Church of England as the panther, the atheists as the ape, the Baptists as the boar, the Presbyterians as the wolf, the Quakers as the hare and King James as the lion. His original intention had been to conciliate the Church of England and to persuade it to make common cause with the Catholics against the Dissenters, who are roughly handled in the early part of the poem; but shortly before the completion of the work the king by a declaration for liberty of conscience made a bid for the support of Dissenters against the Established Church, which left the poet in something of a predicament. In the last division of his piece he abandons his conciliatory tone and turns upon the Established clergy in his fable of the doves with bitter and abusive satire, directed with special sharpness at Gilbert Burnet, who is presented as the buzzard. Dryden's eminence, his change of faith, his position as royal apologist, the multitude of his adversaries and the critical posture of public affairs all combined to give to the publication of his carefully barbed and envenomed satire the effect of an attack of hornets. The poem went through three editions in the first year, and provoked numerous replies, notably Prior and Montague's 'The Hind and the Panther transversed to the Story of the Country Mouse and the City Mouse.' In the somewhat confusing and difficult allegory there are fine passages of genuine piety and a sincere plea for tolerance and liberty of conscience. For further commentary consult Johnson, 'Lives of the Poets'; Scott, 'Dryden' (in the Scott-Saintsbury edition of Dryden's works), and W. H. Williams' edition of 'The Hind and the Panther' (1900).

Stuart P. Sherman.

HINDENBURG, Paul von Beneckendorff und von; German Field-Marshal: b. Posen, 1847; cadet, 1864; lieutenant, 1866; wounded at Sadowa; served in the Franco-Prussian War of 1870–71; present at Sedan and the siege of Paris. In 1873 he entered the War Academy at Berlin, and it may be said that he was a "military student" for the next 38 years. As division staff officer at Königsberg in the early 80's he commenced that profound study of the Masurian Lakes districts which was destined many years later to bring him fame; to make him, in fact, the only really successful general (with the exception of von Mackensen), that Germany produced during the first three years of the great war. He was appointed to the general staff in 1886 and lectured on applied tactics at the War Academy till 1893, making the Masurian Lakes region an important item in his lectures. In 1903 he attained the rank of general; spent considerable time in East Prussia, and commanded in succession the two army corps stationed at Köenigsberg and Allenstein. In every annual manœuvre he regularly rehearsed the defense of the lake region against a Russian invasion. He often used his intimate knowledge to drive his "opponents" into some marshy spots and kept them for hours up to their waists in mud. He resigned in 1911 at the age of 64; but retirement to him meant only more time to be devoted to his all-absorbing hobby of defending East Prussia. He haunted the wilderness on foot, on horseback, in automobile and even with a field gun borrowed from a local garrison. There was the most serious method in his apparent obsession; by his practical tests he found out where a horse or a gun could stand or be driven through; where mud or water was deep or shallow, etc. Year after year his investigations were pursued, and every spot was duly and precisely charted. The crisis of his life came about three years before the war, when a business syndicate proposed to reclaim the Masurian Lakes region. The forests were to be cleared and drainage canals cut through. With furious energy von Hindenburg opposed the scheme, went straight to Berlin, interviewed the emperor, and told him that this eastern wilderness was worth a dozen fortresses and many army corps. He carried his point, and the project was abandoned. On the outbreak of the war in 1914 he volunteered his services, though 67 years old. His offer was at first ignored, and it was not till the Russians had overrun East Prussia, shut up the German troops under General von François inside the Königsberg lines, and were throwing advance cavalry in the direction of Danzig, that von Hindenburg was placed in command. With about 150,000 to 160,000 men he inflicted a terrific, crushing defeat upon the Russians under Generals Rennenkampf and Samsonoff at the battle of Tannenberg. He extended his left in a great curve round the Russian right flank and swept southward; performing the same evolution on the Russian left, he drew two-thirds of a circle around the Russians. The retiring Russian batteries sank into the bogs; horses struggled in vain, and as the iron circle closed in whole regiments were driven into the lakes and drowned in the water or choked in the bottomless mires. Von Hindenburg took some 90,000 prisoners and enormous quantities of stores. The kaiser made him a field-marshal and placed him in command of the eastern armies. He led the great drive into Russia and conquered Poland. See WAR, EUROPEAN; TANNENBERG.

HINDMAN, hīnd'man, **Thomas Carmichael**, American soldier: b. Tennessee, 1818; d. Arkansas, 1868. He studied law, entered practice in Mississippi, fought in the Mexican War as a lieutenant of Mississippi volunteers, and in 1858–61 was a Democratic representative in Congress. Not long after the outbreak of the Civil War he was commissioned brigadier-general, was defeated at Newtonia and Prairie Grove, was promoted major-general at Shiloh and later served in Arkansas.

HINDUISM is the name of a religion which is professed to-day by four-fifths of the population of East India, and which embraces within its folds the subtlest philosophic pantheist and the grossest animist. Unlike any other religion extant in the world, it owes its origin to no individual. Hinduism has passed through various stages of development, distinguishable by marked features; but it would be wrong to associate the stages with any process of evolution. The foundation of the faith is a collection of sacred writ, collectively known as the Vedas or Sruti (revelation). The Hindu Scriptures or the Veda has four subdivisions: *Rig, Yajush, Sāman* and *Atharvan*. Each of the Vedas is further subdivided into *Samhitas* or sacred texts, *Mantras* or hymns and *Upanishads* or philosophic discussions. Besides the *Upanishad*, each Veda has an *Aranyaka*, which is principally connected with methods and efficacy of the worship of the Divine Being. The Hindu tradition is that the Veda, which means "knowledge," is eternal, and like the Divine Being it is ever-existent and part of it. But, the evidence is that all parts of the Veda are not equally old, nor could the authorship be ascribed to a single individual or even a group of individuals. The earliest are the hymns of the Rig Veda, which indicate the purest form of nature worship known to mankind. The grand and striking phenomena of nature are visualized incomparably, and the hymns are dissociated from the mythology usually connected with polytheistic forms of belief. The hymns to Dyapus or the Dawn in the Rig Vega exalts one as no other poetry or any written word does. The idea underlying the hymns was not, however, nature worship. The ancient seers saw the Divine anywhere and everywhere, and they did not consider the world in water-tight compartments. The Divine was in all, and everything was in the Divine.

The deities referred to in the Vedas are *Indra,* the lord of atmospheric region; *Vayu,* the lord of air; *Agui,* the god of fire; *Dyayus,* the lord of dawn; *Varuna,* the lord of water; *Brahaspathi,* the lord of prayer; *Prajapati,* the lord of people; *Visvakarman,* the maker of all. The sage that praises Varuna attributed all creation, all qualities and all power to him, and had no cognizance of the rest of the pantheon. The same sage forgets all but Agui, when he chanted a hymn to him. The underlying thought is that there is only one universal self-existent soul, and that all else are attributes. As the Vedic thought unfolded itself, the universal soul was identified with Bráhma.

But the underlying thought has, of necessity, to suit itself to historic and social conditions. When the first Aryan settlers on the banks of Sindhu wished to chant hymns and devote their entire attention to worship they had to fight and cultivate and provide for their own sustenance. The more they went inside the country, the fiercer was the resistance of the aboriginal tribes, who were called Rakshasas and Pisachas. The necessity of existence led to the division of the people into castes, which, at the outset, was not intended to be the hide-bound system that it latterly grew up to be. The Brahmin became the priest, the Khathruja, the fighter and the ruler, the Vaiśya the trader, and the Sudra the laborer. Caste was defined as *varna,* which is usually foolishly held to denote color by European writers.

On account of the lack of adequate historic material, it is extremely difficult to trace the evolution of Hinduism. Owing, again, to the extraordinarily long period during which the religion has remained a virile force, one can hardly point out any special trait which helped to keep its vigor. If there is any quality above all which distinguishes the religion, it is its catholicism. The Vedic texts, which formed the basis of thought, subscribed themselves to every kind of interpretation put upon them. Throughout the long period of its growth it has assimilated much that should normally be considered alien to it. It found a place for every phase of thought and every grade of life. No special thought, ritual or philosophy was superimposed upon the peoples it came in contact with.

First Period of Development.— From the meagre materials that we have, the first period of the development of Hinduism can be associated with what is known as the sacrificial period. The Vedas were for all practical purposes hymns of worship. They were addressed in beautiful and exalted language to the gods, or the lords of the firmament. Offerings of delicious viands were made to them. Yagnya or sacrificial rites and ceremonies, which at one period was indissolubly connected with elaborate paraphernalia, was the order of the day.

Second Period.— The second period in its development may be called the Epic period. In this period the early Aryans extended the range of their conquest. They moved east from the banks of the Indus to the banks of the Ganges, and south to the banks of the Narbudda and the whole country of Deccan. Deeds of valor were committed in the process of conquest. With conquest came hand in hand assimilation, and all the inhabitants in the vast peninsula of the Hindustan found a place in Hinduism. The 'Ramayana' and the 'Mahabharata' are the two great epics of India, which furnish a fund of information about this period — information which is almost encyclopædic in scope. Just as the 'Iliad' and the 'Odyssey' form the mirrors of the epic age of Greece, so the 'Ramayana' and the 'Mahabharata' furnish a history of the life and thought of India in the Epic age. The 'Ramayana' is the story of the abduction of Sita, the queen of Rama, by Ravana, the Rakshasah king of Ceylon, the quest, the conquest of Ceylon and the destruction of Ravana's empire and the recovery of Sita. The 'Mahabharata' is the story of the wrongful possession of Yudishtara's throne by his cousin Duryodhana, the final defeat of the latter and the return of the throne to the rightful owner. These epics have long formed part and parcel of the life of the people of India, and even to-day have more influence on life and thought in that country than the Bible in Christian countries. The stories in the epics are merely threads on which are made to hang treatises on every phase of life, morals, religion, laws and government.

The definitive establishment of the Brahminical hierarchy follows closely the Epic period. There is a void between the close of the Epic period and the rise of the Brahminical era. It is generally believed that during this period there was a struggle between the Brahmins and the Khshatriyas, or the soldier class, for power, and that the former won. The legend of Parasurama is quoted as exemplifying the fall of the Kshatriya. The Dharmasutra, or the Code of Laws of Manu, reproduces on the whole pretty faithfully the state of Hindu society a few centuries before the Christian era. The Brahmins improved their newly acquired vantage ground by investing everything connected with their order with a halo of sanctity, calculated to impress the lay community with feelings of awe. They invested the later religious literature, so imbued with their own aspirations and importance, with the same authority as Sruti or revelation. In their division of castes, and penalties to be inflicted for transgressions of the limits assigned to each, they forged the chain of their own supremacy. But it must be said to their credit that they denied themselves wealth and all means of acquiring wealth. No Brahmin was allowed to be a king. The most rigorous duties were imposed on the Brahmin. While the lowest, or Sudra caste, was apparently treated without clemency, the real fact is that the punishment for any infraction was humane. The Brahmin had not to undergo severe physical penalties; but he lost caste. The Sudra may rise to be a member of a higher caste. A Brahmin once fallen is fallen forever, and is ever the object of direct contempt. The three first castes, the Brahmin, Kshatriya and Vaiśya were united by a bond of sacramental rites (Sanskaras) traditionally connected from ancient times with certain incidents and stages of the life of the Aryan Hindu, as conception, birth, name-giving, the first taking out of the child to see the sun, the first feeding with boiled rice, the rites of tonsure and hair-cutting, the youth's investiture with the sacrificial thread and his return home on completing his studies, marriage, funeral, etc.

The first three castes were considered the twice-born, because of their right to participate in ceremonials. The Brahmin had to go through four stages in life, i. e., student, householder, anchorite and recluse; while all the twice-born were entitled to do the same. According to the Hindu, there are four sacred "debts" which a man has to discharge in life, i.e., that due to the gods, and of which he acquits himself by daily worship and sacrificial rites, that due to the rishis, or ancient sages, discharged by the daily study of the scripture; that due to his manes, or ancestors, which he discharges by leaving a son; that due to humanity, which demands his continually practising kindness and hospitality. The domestic fire must be continually kept up, and never allowed to be extinguished.

The Development of Hindu Philosophy. —The next stage of Hinduism is the development of philosophic thought. At about this time the Aryan Hindus had consolidated their conquests, and had time to devote to speculation. The fundamental thought that union with the Divine is the *summum bonum* of all existence underlies all developments of the religion. In the very early periods, hymns were the means. In the Epic period, the doctrine was prevalent that the union of the human with the divine soul of existence was aided and expedited by penances of various kinds, collectively known as *Yoga*. In the next period, special stress was laid on sacrificial offerings, especially household rites with elaborate ceremonies. Doubt arose in the minds of many as regards the utility of penances or sacrifices. Just as the original hymnmakers of the Vedas speculated on existence in the Upanishad, so the later Hindus began to speculate on existence. At first, there was confusion of thought, because the existence of a universal spirit was not considered incompatible with the doctrine of a personal creator. Having devoted all their time and attention to sacrificial rites, they had failed to bring about a distinct formula of faith. The general drift of thought became pantheistic, although the ancient forms of belief still largely entered into it. Systems of philosophy grew up in the attempt to solve questions of the origin and destiny of man, and his relation to the Supreme Being. The six well-known schools of philosphy are known as the Nyaya, Vaiseshika, Sankhya, Yoga, Mimamsa and Vedanta. They all agree in that their object was to prescribe rules by which man may be delivered from the bondage of ignorance, and be absorbed in the all-pervading divine soul. Their doctrine of the soul as something eternal and inextinguishable, distinct from mind, senses and body, yet sharing in the merits and demerits of good and bad deeds, the latter of which are caused by ignorance of what is best and highest, is identical. They agree so far as to how ignorance can be gradually eliminated and right apprehension acquired; to this end scriptures must be studied and clearness of mind and heart secured by sacrifices, almsgiving, pilgrimages and prayer. There was no question as regards what is best from an ethical point of view. There has also been no question as to the necessity for the attainment of the Divine. The point of conflict was mainly as regards speculative thought. These systems of philosophy were restricted in their scope, because they all acknowledge that the Veda was the fountain head of all knowledge, and an authority which cannot be questioned. On the other hand, they had a very wide latitude, because it was ever possible to quote some passage or other in the Veda to support any statement. The final result of the development of speculative thought was the enthronement of Brahman, as the be-all and end-all. The idea of a personal deity lost all force and the Great Abstract was the good of all existence, and all existence was in it. The Vedanta philosophy was the culmination of the speculative thought of the Hinduism. See VEDANTA.

Although the new dogma satisfied the aspirations of the most developed speculative minds, the votaries of the religion as a whole could neither comprehend nor take interest in it; an abstract, colorless superentity like Brahman awoke no sympathies in the hearts of those who can have no conception of God except as a personal entity. Even when the primitive symbolic worship of nature as seen in the Hymns of the Vedas had not been touched by philosophic speculation, the mass of the people were drifting away toward the worship of gods of flesh and blood. Different localities became attached to the worship of a particular deity with special attributes. The thoughts and observances of the original inhabitants of the country had also had some influence on the Aryan settlers. The priesthood was loath to give away to the superstitions and deity worship of the common people, and would gladly have raised them to its own level if it could. Attempts made in that direction signally failed. The only way open was for the priesthood to recognize and incorporate into their system some of the most prominent objects of popular devotion, and thereby to establish a kind of catholic creed for the whole community subject to the Brahminical law. The pantheistic thought that had already been highly developed also helped toward that end in view. *Siva* or *Mahadeva* and *Vishnu* were the two popular deities at the time, and they were admitted into the folds of the higher Hindu thought. This was only the beginning. A whole host of gods and goddesses then claimed recognition. Every small community had its local deity, and to refuse recognition would have meant the straying away of that community from the Hindu faith. The Brahmins settled the vexed question without, in any sense, giving up their own Vedantic faith. As the Brahman was in all, and all was Brahman, what was there to prevent any object being identified with it, so long as there can be no other? What was, after all, in a name? Why should not the Brahman be called Vishnu, Rudra, Siva or Mahadeva? Life was meaningless without symbolism; and the local deities were only symbols. The populace, however, did not take the position; that the Brahmins proposed to remedy by gradual education.

The result was that a whole pantheon of gods was created. Imagination was let loose and had a riotous play. Gods and goddesses by the galore peopled the firmament, although however only a handful found deification in the sense that they became objects of worship. New worlds were created, and Indra was made the ruler of 330,000,000 divinities. The trinity of Hinduism came into being in Brahma, the creator, Vishnu, the preserver, and Siva, the destroyer. The cosmogony of the world became extraordinarily interesting. The universe, before undiscerned, was made known by the sole, self-existent Brahman. The latter willed to produce from his own substance various lives, which were dormant in, and part of, him, created the waters by meditation. Out of the ultra-universal deluge was created Brahma, the creator of all things. Brahma, or the creator worship, did not last, because there were no votaries, and the idea was an innovation made to fit in with an artificial cosmogony. With Vishnu and Siva, however, it was different. The old conception of Vishnu as that of kindly protector appealed to the masses. He has been represented as undergoing, for the benefit of mankind, a number of avatâras, or incarnations. The object for which Vishnu assumes a human form is always to deliver the people from the oppression of some wicked prince or influence, or when the world is overwhelmed in vice and has to be restored to virtue or Dharma. Siva is the destroyer, also known as Rudra, the god of the roaring storm, usually portrayed, in accordance with the element he represents, as a fierce and destructive deity. But he is worshipped, because he is held to symbolize the destruction of sin and the unrealities and illusions of worldly existence, thus leading the soul to its goal. To give even a cursory idea of the various deities in the Hindu pantheon would take volumes. The basis of the pantheon is the Puranas, of which the most noted are 18. Besides the Puranas, there are commentaries and works which exalt the particular deities of noted votaries. All the deities, however, are either the incarnations or attributes of Vishnu or Siva.

The Puranic period of Hinduism was contemporaneous with Buddhism. Before the rise of Buddha the religion consisted either of elaborate sacrificial rites or pure philosophic speculation. Buddha found that the masses were ignored, and his teachings were practically protestant Hinduism. The populace saw a new light and went *en masse* to Buddhism, especially as the votaries of the religion included such eminent monarchs as Asoka. There was something mellow in the new faith which appealed to popular imagination. The Brahmins found that their hold was being wrenched from them. They did the best they could, and succeeded in driving Buddhism out of India. They incorporated all that was best in the latter religion into their own faith; in other words, they killed Buddhism by adopting it. In this process, the religion had two new accretions. One is the doctrine of metempsychosis. The doctrine of the transmigration of souls was not altogether new to the seers of the Vedas. But they did not emphasize it. The emphasis laid by Buddha proved a soothing balm to the masses, because they felt that they had always a chance to attain salvation so long as they had a series of lives to achieve it in. The next accretion was that of Divine Mercy. Humanity has ever been noted for its weakness in as much as it is easily tempted away from the right path. But for the Divine guidance and mercy there is little for man to place his hopes on. The exaltation of mercy again appealed to the popular imagination. But Hinduism never accepted the doctrine of vicarious punishment. Every individual soul was meted out its due desserts. There was no reward for virtue or punishment for vice; each act had a certain result which must inevitably follow. But the Divine Mercy held a light, as it were, for the soul not to stray from the right path.

The doctrine of right was also developed during this period. Hinduism considers all life relative, and hence there is no cut and dried line of demarcation between vice and virtue. The code of morals is just the same as in all religions. But in the philosophic discussion of it, the religion holds that as the Divine is in all and is all, the distinction of right and wrong is purely one inevitable in the world of limitations, and is purely subjective.

Hinduism is, in the popular European conception, identified with idolatory. The mistake arises out of not understanding the Hindu mind and the chain of circumstances that brought about the worship of idols. Before the spread of Buddhism there were no idols or temples in India. But votaries of Buddha set up his image in different parts and made obeisance to it. When, however, Buddhism was incorporated into Brahminism, the latter took over the temples and allowed the masses to use idols of their particular deities. The idols were only symbols, a form which makes the worship of the Divine convenient and easy for the average men and women. Later, of course, there was a degeneration in that the masses began to believe that there was special virtue in the idols.

Such in brief are the tenets of Hinduism and the history of that religion up to the date of the Mahommedan conquest of India. Since the 13th century the religion has, for all practical purposes, stagnated. Much that is alien to the faith crept in, and the leaders had to incorporate customs and manners that were repugnant to them. The caste system, which was elastic up to that period, became petrified and fossilized, much to the detriment of the real interests and growth of the country. The Purdah system was then introduced in order to protect the honor of their womankind from the unscrupulous foreign hordes that ravaged the country from time to time. The schools and universities that flourished in India either degenerated or were closed. The populace had little or no guidance in molding its religious thought, which gradually descended into the grossest mysticism, meaningless rites and unsavory practices. Occasionally reformers like Kabir, Tulsi Das, Ramanuja and Ramananda attempted to correct the evils. Little, however, was done.

The establishment of British rule brought with it a vigorous proselytizing activity on the part of Christian missionaries. The newly acquired knowledge and a wider conception of world affairs put new life into the religious thought of India. Ardent reformers arose by the score and strove for the purification of the religion of their ancestors, and a proper dissemination of religious knowledge both to their own people and the rest of the world. The two most important movements that have achieved some results are the Brahmo Samaj and the Arya Samaj. The Brahmo Samaj owes its existence to Rajah Ram Mohun Roy, and was vigorously preached by the famous reformer Keshub Chunder Sen. The movement was ambitious and proposed to create a universal faith, although it immediately occupied itself with the purification of the Hindu faith. The movement never had more than a handful of followers; but it had an important effect on orthodox thought and practises, not only in Bengal, which was its birthplace, but also in all parts of India. The Arya Samaj owes its origin to Dayanand Saraswati, in Punjab. He proposed to go back to the faith of his ancestors and would not accept any other text but the Vedas as authority. The movement has succeeded extraordinarily well. It has broken the backbone of the caste system in many parts of the country and has a large number of adherents.

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SRINIVAS R. WAGEL.

HINDUSTAN, hĭn-doo-stän′, **HINDOSTAN,** hĭn-dō-stän′, or **INDOSTAN,** signifying «the land of the (river) Indus,» a word of Persian derivation, formerly applied to India (q.v.).

HINDUSTANI LANGUAGE AND LITERATURE. Hindustani is the name given to the current vernacular of northern India. In structure it is based originally on a branch of the ancient Sanskrit, descended from a sister dialect and strongly modified by the various forms of Prakrit during the Middle Ages. The name Hindustani itself is derived from modern Persian — Hindi (Indian). Hindustani is split up, however, into some 60 subdialects, and these, while all strongly resembling each other, are shading off one into the other according to geographical boundaries, so that in the eastern region they rather tend toward Bengali and in the southern and western toward Marathi and Gujerati. The territory within which Hindustani is spoken in its various types is the most densely populated in India, for on but 248,000 square miles it is inhabited by 100,000,000 souls. The dialect of Hindustani enjoying a sort of pre-eminence is the Braj Bhâsha, which prevails in the region of Delhi, Agra and Muttra. Hindustani contains also in varying degree a strong admixture of Arabic, Persian, Turkish and Tartar, as well as many words of Dravidian and Kolarian. When the latter is considerable, Hindustani is termed *Urdû*, meaning in Turkish «camp,» «army,» and the term itself as well as the facts it stands for go back to the Mongolian and Turanian invasions of the 12th and subsequent centuries. It was Urdû which became the accepted court dialect at Delhi, but a literary form of Urdû, richer in Persian elements, came to be known as *Rekhta*. During the last hundred years, however, by dint of strenuous efforts of grammarians and teachers, Hindustani has been greatly purified and purged of elements not cognate. Upon this purified Hindustani again has been conferred the appellation of Hindi, or High Hindustani.

As for its makeup Hindustani is an analytical tongue. Like modern Persian and also like other dialects of India it has had its grammar greatly simplified. Tenses, cases, etc., are indicated by means of prepositions, auxiliary verbs, etc. However, there are at least two genders, two numbers, two voices and nine tenses. Many of its constructions resemble analogous English ones closely, as «I am going to see,» *main dekhûnga;* «I am seeing,» *main dekhto hûn,* etc. Hindi and Hindustani are both written with the characters of the Devanâgari alphabet, as are Sanskrit and Marathi. But Urdû, faithful to its mixed origin, uses the Perso-Arabic script, with three additional characters to represent specifically Indian sounds.

Hindustani literature is very abundant, although with few exceptions of mediocre quality. Its oldest achievement is the epic of Chand Bardai, the «Prithvirâj Râsaū,» dating some 700 years back, in which the long sad story of the last Hindu ruler at Delhi is told. «Hammîr Deô,» by Sàrangdhar, about 1363, describes the heroic fight made against the Sultan Aladdin Khilji, in 1300. The same author also wrote the «Hammîr Kâvyâ» and the «Hammîr Râsau,» similar warlike tales in epic form.

«Chattra-Prakâs,» by Lâl Kabi, is a long chronicle reciting the deeds of Rajah Chattarsâl, who was killed in the battle of Dholpûr, won by Aurangzeb, in 1658. «Padmâwat» another epic, written in 1540, had a Mohammedan, Malik Mohammed, for its author. The poem, written in the purest dialect of Avanti, is based on the loss of his throne of Delhi by Humâyân. The literature of the *Bhagats*, worshippers of Vishnu and adherents of a purified form of Brahmanism, is very extensive and has no doubt exercised much influence on national Hindustani speech. The name, Bhagats, means «Children of the God.» In the line of fiction, the «Purânas» («Old Stories») are notable.

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WOLF VON SCHIERBRAND,
Author of ‘America, Asia and the Pacific’; ‘Germany: the Welding of a World Power,’ etc.

HINGHAM, hĭng ạm, Mass., town in Plymouth County; on Massachusetts Bay, and on the New York, New Haven and Hartford Railroad; about 15 miles southeast of Boston. In the town are the villages of South Hingham, West Hingham, and Hingham Centre. The first permanent settlement was made in 1633, and it was then called Barecove. In 1635 it was incorporated under its present name. Its chief manufactures are awnings, cordage, woodenware, toys, bootheels, furniture, leatherette and upholstery. The harbor was improved in 1911 by the State and Federal governments. It has a meeting-house which was built in 1681. It contains a public library and is the seat of Derby Academy. Some of the noted people who have lived in Hingham are John A. Andrew, John D. Long, Benjamin Lincoln and James Hall, the famous geologist who for a number of years was State geologist of New York. Joshua Hobart, the Puritan ancestor of the Hobarts of New York State, also lived in Hingham. The government is arranged by town meetings. Pop. 4,965. Consult Cornish, L. C., 'Settlement of Hingham, Mass.' (Hingham 1911); Lincoln, 'History of the Town of Hingham.'

HINKSON, Katharine Tynan, Irish novelist and poet: b. Dublin, Ireland, 3 Feb. 1861. She was educated in a convent at Drogheda and since her marriage to H. A. Hinkson in 1893, has lived in Ealing, a suburb of London. She is a voluminous writer both in prose and verse; but as a poet she has won the greater fame. She was one of the originators of what was known as the Irish Literary Revival. Her volumes of verse include 'Shamrocks' (1887); 'Ballads and Lyrics' (1890); 'Cuckoo Songs' (1894); 'Miracle Plays' (1895); 'The Wind in the Trees' (1898); 'Collected Poems' (1901); 'Innocencies' (1905); 'New Poems' (1911); 'Irish Poems' (1913).

HINMAN, Russell, American editor of textbooks: b. Cincinnati, 23 Jan. 1853. He was educated at Antioch College, Ohio, went into business as a civil engineer; and later became editor of geographical textbooks for Messrs. Van Antwerp, Bragg & Co. of Cincinnati. Since 1890 he has been in charge of the editorial office of the American Book Co. He has written 'Eclectic Elementary Geography'; 'Eclectic Complete Geography'; 'Eclectic Physical Geography.'

HINNOM, Valley of, a ravine near or at Jerusalem, the exact location of which has not been determined. Here children were sacrificed to the god Moloch, and for this reason the valley was deemed accursed. Under the name of Gehenna, Hinnom became synonymous with Hell (q.v.).

HINOJOSA Y NAVEROS, hē'nō-yō'sa i nä'vér'ōs, **Eduardo de,** Spanish public official and educator: b. Alhama, Spain, 25 Oct. 1852. He received his education at the universities of Granada and Madrid and from 1875 to 1882 was an assistant in the National Archæological Museum, Madrid. From 1882 to 1900 he was professor at the Madrid School of Diplomacy, serving meanwhile as civil governor of Madrid in 1897 and in 1900. Since 1900 he has been professor of ancient and mediæval Spanish and American history at the University of Madrid. He is a Senator of the Kingdom and director general of public instruction, member of the Commission on Archives, Libraries and Museums. In 1908 he was elected honorary president of the Congress of Historical Sciences, Berlin. He is also member of the Royal Academy of Spain, the Royal Historical Academy, the Royal Academy of Moral and Political Sciences, and corresponding member of the Institute of France. He has published 'Historia del derecho español'; 'Estudios sobre la historia del derecho español'; 'El régimen señorial y la cuestión agraria en Cataluña durante la Edad Media'; 'Influencia de los teólogos y jurisconsultos españoles,' and contributions to 'The Catholic Encyclopedia.'

HINOYOSSA, hē-noi-ŏs'sä, **Alexander d',** Dutch colonial governor in America; b. and d. Holland. He came to America in 1650 as lieutenant in a small military force sent to accompany 150 immigrants. In 1659 he became director of Nieuer Amstel, a Dutch colony on the eastern bank of the Delaware River. Although, owing to disagreements and illness, this colony was not at first a success, it was greatly developed by Hinoyossa's wise rule. Hinoyossa was for a time involved in a conflict of authority with Director Petrus Stuyvesant of New Amsterdam, who had general superintendence of the commissioners constituting the government of Nieuer Amstel. In 1663 he obtained authority over all the settlements on the Delaware. The Swedish colonists submitted and Stuyvesant relinquished his control. Upon the conquest of New Netherland by England, Hinoyossa returned (1674) to the continent where he fought in the Dutch army against the French invasion by Louis XIV.

HINTERLAND, the land behind a coast or river: common in the phrase "doctrine of the hinterland." This doctrine was first advanced by Germany in 1883 by claiming that she had exclusive right to occupy certain territory behind the parts of the African coast over which she already ruled. This territory, it was claimed, extended back without defined limits until it reached the official boundary of territory controlled by another power.

HINTON, Richard Josiah, American author: b. London, England, 25 Nov. 1830; d. 20 Dec. 1901. He settled in the United States in 1851; studied topographical engineering at the Columbia School of Mines; and removing to Kansas in 1856 became a supporter of the cause of John Brown. He served in the National army in 1861–65; and was the first white man appointed to raise and lead colored troops. After the war he engaged in newspaper work in Washington, New York and San Francisco. He was the author of 'Life of William H. Seward'; 'Life of Gen. P. H. Sheridan'; 'John Brown,' etc.

HIP, that part of the trunk comprised between the abdominal wall and the lower limb, particularly the region over the hip-bone (the crest of the ilium).

HIP JOINT, the joint of the upper leg or thigh (femur) where it joins the trunk. It is a ball and socket joint, formed by the sinking of the smooth globular cap into the deep hollow, called acetabulum (vinegar bowl), of the os innominatum. Its movements are controlled by five ligaments: the capsular; the ilio-femoral; the teres; the cotyloid; and the transverse. These movements are more wonderful than even those of the arm, being flexion, extension, abduction, adduction and rotation inward and outward. It is the most powerful joint in the body and hardest to dislocate.

HIP JOINT, Disease of, a disease of the ball and socket of the hip. It is most frequently a type of tuberculosis; comes on in children or young persons, from very slight accidents which have caused an injury to the joint which, becoming infected, then develops the disease; is often traced to a long walk, a sprain in jumping or a fall. In the early stage of the disease the whole of the structures of the joint are inflamed and after proper treatment may be sometimes subdued with no worse consequences than a more or less rigid joint. Usually, however, abscesses form around the joint and often communicate with its interior; and the acetabulum and the head and neck of the thigh-bone become disintegrated, softened and gritty. In a still more advanced stage, dislocation of the head of the thigh-bone commonly occurs, either from the capsular ligament becoming more or less destroyed, and the head of the bone being drawn out of its cavity by the action of the surrounding muscles, or from a fungous mass sprouting up from the bottom of the cavity and pushing the head of the bone before it.

As the disease advances, abscesses occur around the joint. True shortening of the limb now takes place, which at the same time becomes adducted and inverted. From this stage, if the health is pretty good and the lungs are sound the patient may be so fortunate as to recover with an anchylosed (or immovable) hip-joint; but the probability is that exhaustion and hectic will come on and that death will supervene from the wasting influence of the purulent discharges occasioned by the diseased bone. See Tuberculosis.

HIPPARCHUS, hĭ-pär'kŭs, Greek astronomer: b. Nicæa, in Bithynia. He lived about 160–125 B.C.; resided for some time at Rhodes, but afterward went to Alexandria, then the great school of science. A commentary on Aratus is the only work of his extant. He first ascertained the true length of the year, discovered the precession of the equinoxes, determined the revolutions and mean motions of the planets, prepared a catalogue of the fixed stars, etc.

HIPPARION, hi-pā'rĭ-on, a genus of fossil three-toed *Equidæ*. See Horse, Evolution of.

HIPPELATES, a genus of midges to whose agency is ascribed the spread in many instances of the southern ophthalmic disease of cattle called pink-eye. See Flies; Pink-Eye.

HIPPOCRATES, hĭ-pŏk'ra-tēz, Greek physician, the father of medicine: b. in the island of Cos, 460 B.C.; d. Larissa, Thessaly, 357 B.C. Besides practising and teaching his profession at home, he traveled on the mainland of Greece. His writings, which were early celebrated, became the nucleus of a collection of medical treatises by a number of authors of different places and periods, which were long attributed to him and still bear his name. The best edition is that of Littré (in 10 vols., Paris, 1839–61). He has the great distinction of having been the first to put aside the traditions of early ignorance and superstition and to base the practice of medicine on the study of nature. He maintained, against the universal religious view, that diseases must be treated as subject to natural laws; and his observations on the natural history of disease, as presented in the living subject, show him to have been a master of clinical research. His accounts of phenomena show great power of graphic description. In treating disease he gave chief attention to diet and regimen, expecting nature to do the larger part. His ideas of the very great influence of climate both on the body and the mind were a profound anticipation of modern knowledge. He reflected in medicine the enlightenment of the great age in Greece of the philosophers and dramatists.

HIPPODROME (from the Greek, *Hippos*, a horse and *Dromos*, a race course), the name given by the Greeks to places where races were held. This included both chariot and single horse racing, but the hippodrome later took the form of a circus, other games, such as wrestling, boxing, running, etc., being added, and for a short time after the introduction of Roman customs and manners it became the scene of gladiatorial combats, but as sights of this nature did not find favor in the sight of the Greeks, these combats were eventually eliminated and the main feature of the games, as in the beginning, was the chariot race. To the brutal taste of the Roman populace flowing blood acted as an elixir, but to the more refined Eastern people the amphitheatre was abhorrent. Though numerous amphitheatres were scattered throughout western Europe very few were ever built within the limits of the Eastern empire and then only where the influence and manners of the Romans were most powerful.

The first mention of a hippodrome is made by Homer, but it is believed that the term then applied to any course over which a race of any kind was run and that it did not necessarily have a fixed location. As the chariot-racing became the national game, the proper courses for the holding of such events became necessary, as in these races, though much of the success depended upon the courage and skill of the driver, the loss of life was often great, through collision, the overthrow of the chariot in turning caused by rough grounds, the breaking of an axle, or numerous other accidents. The hippodrome was built for the purpose of avoiding, as much as possible, the possibility of such mishaps, by providing a wide and smooth track, thus leaving plenty of space for the contestants. Of the ancient hippodromes (as distinguished from circus, amphitheatre, etc.), probably the most famous are those of Olympus and of Constantinople, and while the Circus Maximus of Rome may to a great extent have been more of a circus than race course, it was planned after the Greek race courses, was used by the Romans for this purpose and thus may properly be classed with the other two.

The origin of the hippodrome at Olympus tradition gives to Hercules. Of its length and breadth there was until recently no precise information, the overflow of the Alphus River having washed away the indications of its limits. A Greek manuscript found recently in the old Seraglio in Constantinople gives its dimensions. The total circuit was eight stadia (about 0.95 mile), but the actual course was six stadia. The breadth was 320 feet. Riding races consisted of but one lap (six stadia). The mule chariot race seems to have been about eight and one-half miles.

In general form the hippodrome was an oblong, one end of which was semicircular; on three sides having seats for the populace and on the fourth, where the races were started, seats for the royalty and nobles. The right side, formed by an artificial mound, was a little longer than the left side, which was built on the natural slope of a hill, the base of the fourth side being formed by the portico of Agnaptus, named after its builder. The form of the starting place was not unlike the prow of a ship, each side being 400 feet long and containing stalls for the chariots and their horses. In the arena were two goals around which the chariots passed several times to complete the race; one of these goals having a bronze statue of Hippodameia upon it, the other an altar dedicated to "Taraxippus, the Terror of the Horses." The principal difference between the Greek hippodrome and the Roman circus was in the width of the arena, in the latter only four chariots being able to race at one time; there was also some slight difference in the arrangement of the carceres.

The erection of the hippodrome of Constantinople was due to two Roman emperors, Septimus Severus and Constantine the Great, who each in turn captured Byzantium by storm. About six years after its capture by him (197 A.D.) Severus commenced operations a little to the west of Byzantium, but in that year was called away by a rebellion in the West and never returned to the city. For over a hundred years it remained untouched, until 323, when Constantine, having conquered the city, pushed the work to completion after changing the details in the original plans. On 11 May 330 it was inaugurated.

The external appearance of the hippodrome was imposing for its vastness, its height and even for its beauty. The walls were of brick, laid in arches and faced by a row of Corinthian columns 260 in number and standing 11 feet apart. There were four entrances from the city each flanked with towers, but of the stairways leading to these entrances no description has come down to us.

Some idea of the immensity of this prodigious structure may be given by the fact that its dimensions were 1,400 feet in length by 400 feet in width, covering an area of 535,866 square feet, or 12.3 acres. On the north was a structure containing the apparatus for the games, the servants' and attendants' apartments, the chariots and horses, the arsenal, etc., called by the Romans the *carceres* and by the Greeks *μάγγανᾳ*. This apartment was separated from the arena by pillars with latticed gates, 12 in number. Next to these gates was the little church or oratory, where the rival contestants prayed before the games.

The ground story was 20 feet high. On it rested the palace of the Kathisma or Tribunal, in the centre of which, supported upon 24 marble pillars was the platform in Kathisma proper, on the front of which was the emperor's throne. On either side and a little below the emperor were the seats for courtiers, ambassadors, etc. Far down the western side of the hippodrome and nearly opposite the built column was the gorgeous chamber of the empress, this supported upon four porphyry pillars and hence called the tetrakion.

The eastern, western and southern portions were occupied by parallel rows of seats, apportioned to the spectators according to their rank. Behind these rose tier upon tier of benches until nearly half way to the top where was a broad promenade bounding the entire extent of the hippodrome except on the northern side. This promenade was without roof or covering, and, standing nearly 40 feet above the ground, protected by a solid marble railing reaching to the breast, the spectator had a spacious avenue 2,766 feet long. It is estimated that the hippodrome would seat 60,000 persons and have comfortable standing room for 20,000 more, while with a little crowding 100,000 might be accommodated.

The arena was 211 feet wide by 1,190 feet long and was bounded by a narrow walk called the Euripus, paved in tesselated stone. The semi-circular southern portion of the arena, that was included in the curve of the Sphendone, was reserved for the criminals and there too was the place for executions. In the centre of the arena and lying parallel to it was the Spina; a stadium, 607 English feet in length, it marked and governed the beginning, duration and end of each course of a race. At each end of the Spina was a high, narrow framework, surmounted by seven poles, on one group being placed seven fish, on the other seven eggs; one of each was taken down upon the completion of each circuit during the race until the race finished. Toward the southern end of the Spina was the Phiale, a broad basin of running water devoted to the victims of accidents. The space between the northern goal and the carceres was called the Stama, where wrestlers and acrobats performed.

Many additions to the works of art already gathered by Constantine were made during the 700 succeeding years, but in 1203 the hippodrome was sacked by the Franks and Venetians and all were either carried off or destroyed. The most famous of these was the 'Four Golden Steeds,' which was stolen by the Venetians and which in turn was brought to Paris by Napoleon, and is now standing guard over the main entrance of the cathedral of Saint Mark. Among the others are the statues of Hercules, the She-wolf and Hyæna, the Virgin Goddess Diana, the Brazen Ass, the Caledonian Boar, Helen of Troy, the God of Wealth and eight Sphinxes, beside the statues of the early Roman emperors, martyrs, teachers, philosophers, etc. In the early days of the city games were of frequent occurrence, but as time went by they became less and less frequent owing probably to the great cost (it is estimated that a single celebration cost 1,000,000 francs) and at last were celebrated only on 11 May and 25 December, the birthdays of the city and Christ respectively.

It is not known precisely when this hippodrome was entirely destroyed, but as there is no definite reference to any chariot race later than the reign of Isaac Angelus, who was dethroned in 1195, and as the place was sacked in 1203–04 it is probable that it did not survive the beginning of the 13th century.

The Circus Maximus at Rome was for a long time the only structure of its kind in the world, taking its form from the Greek hippodrome and furnishing the model for all later *circi.* In the Vallis Murcia, between the Palatine and Aventine hills, wooden seats were first constructed by Tarquinius Priscus (Liv. I, 35); were frequently burned and rebuilt until the time of Julius Cæsar, when the steps were constructed of stone and greatly improved. At that time it probably accommodated about 100,000 people. After its destruction by fire in 31 B.C. Augustus completely restored it, making several magnificent additions. The upper tier of seats on the Aventine side was again detroyed by fire in 36 A.D, but Claudius not only restored these, but greatly enlarged the entire circus. These additions were supplemented by others made during the reigns of Trajan and Constantine until it was estimated that the circus held 385,000 spectators, while the ‹Notitia› places the possible number at 485,000.

The general plan of the Circus Maximus compared favorably with the Greek hippodromes, the main difference being in the arena around which Cæsar had constructed a moat 10 feet wide and 10 feet deep to prevent beasts from injuring the spectators, and in the width of the arena as before stated. Before the reign of Augustus the circus was used for gladiatorial fights with wild beasts and other forms of butchery, but after the erection of the amphitheatre of Statilius Taurus the circus was no longer used for such purposes. The popularity of this as of the Greek hippodrome also declined and it gradually decayed, now only a few of the remains standing.

The term hippodrome has also been applied to race tracks in England and on the continent, the most famous of these so-called hippodromes being those at Vincennes, Longchamps, Chantilly in France, Newmarket and Epsom in England, and Curragh in Ireland. The modern hippodrome, or indoor circus, had its beginning in Paris, where the first was constructed in 1845. It was built entirely of wood, the arena was 108 metres long and 104 wide, and it had a seating capacity of 15,000 persons. This was destroyed in 1870 by fire. The word hippodrome was first utilized in this country when Franconi conducted a circus at 23d street and Fifth avenue, New York.

The first hippodrome of the accepted type to be built in America was the New York Hippodrome, which occupies an entire block on Sixth avenue, between 43d and 44th streets. This structure was begun on 1 July 1904 and finished in five months, the opening performance occurring 12 April 1905. The main façade has a length of 200 feet, and the buildings extends 240 feet east on 43d and 44th streets. It is built of brick, marble and steel, and rises to a height of 72 feet on Sixth avenue, and 110 feet in the rear, the total cost being $1,750,000. It is the largest playhouse in the world, having a seating capacity of 5,200.

In the interior decorations the general scheme of coloring is a Roman red as a background, with all the structural features done in ivory, gold and silver. The carpetings are of the same color, and the wall hangings, draperies and upholstery are executed in a Roman red velvet enriched with heavy gold and silver embroidery and tassels.

The auditorium is about 160 feet long and 160 feet wide in the first story, and the balcony and gallery occupy the building in front of the stage above the first story. At the rear of the balcony is the mezzanine floor, below the rear seats of the balcony being the wide segmental promenade with main entrances and flights of shallow stairs at each end leading to the street. Behind the promenade the space, 20 to 50 feet wide and 200 feet long, is occupied by smoking rooms, parlors, waiting rooms and cloak rooms. The promenade and lobbies are finished in marble and cæn-stone, relieved by rich illuminations of the ornamented parts in gold and silver. A special feature of the auditorium is the arrangement and construction of cages for animals of the feline kind. Their dens are arranged in a segmental curve in the promenade floor and have plate glass fronts with iron bars behind.

The chief point of interest in the hippodrome centres in the stage and the entirely novel mechanical arrangements for operating the movable platforms, filling and emptying the tank, raising and lowering the stage and handling the scenery. The depth of the stage from the extreme front to the back wall is 110 feet, or 50 feet from the back wall to the proscenium opening and 60 feet from the arch to the front of the stage. This latter part of the stage lying forward of the proscenium arch is known as the «apron.» It is large enough to contain two regulation circus rings, each 42 feet in diameter. Beneath the «apron» is built a huge steel and concrete tank, over 14 feet in depth and large enough for the whole «apron» to sink within it. When aquatic performances or naval pageants are given the tank is filled with water and the movable «apron» is submerged below the water to the bottom of the tank.

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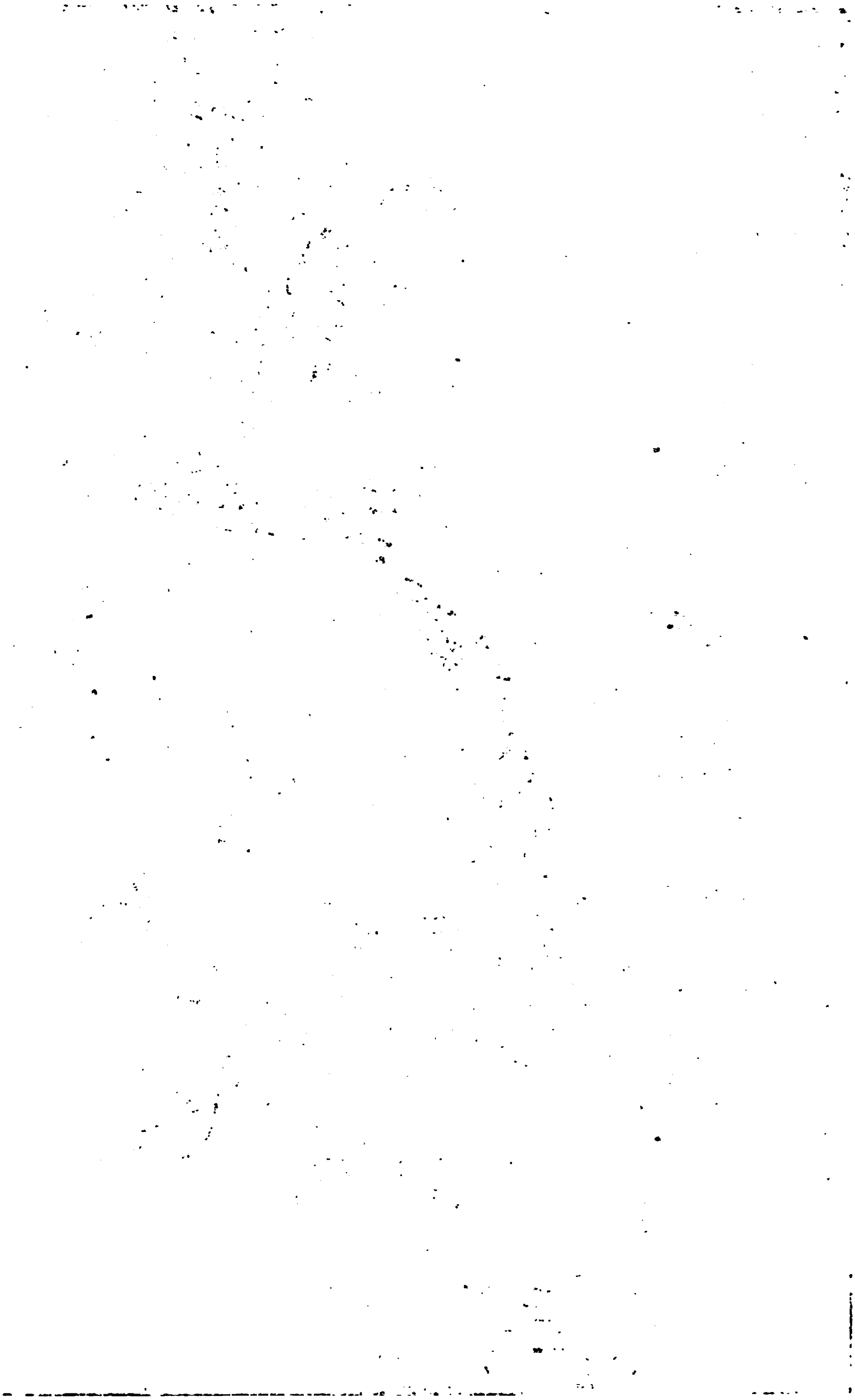
HIPPOLYTUS, a saint and martyr of the early church, who flourished early in the 3d century. He was of Greek family, was converted to Christianity and eventually became a presbyter of Rome. His opposition to his bishop Zephyrinus, and to Calixtus, his successor on questions concerning Christology and discipline resulted in a schism. The dissenting party chose Hippolytus as its head, which position he maintained until about 235, when he was banished to Sardinia. Here he died shortly



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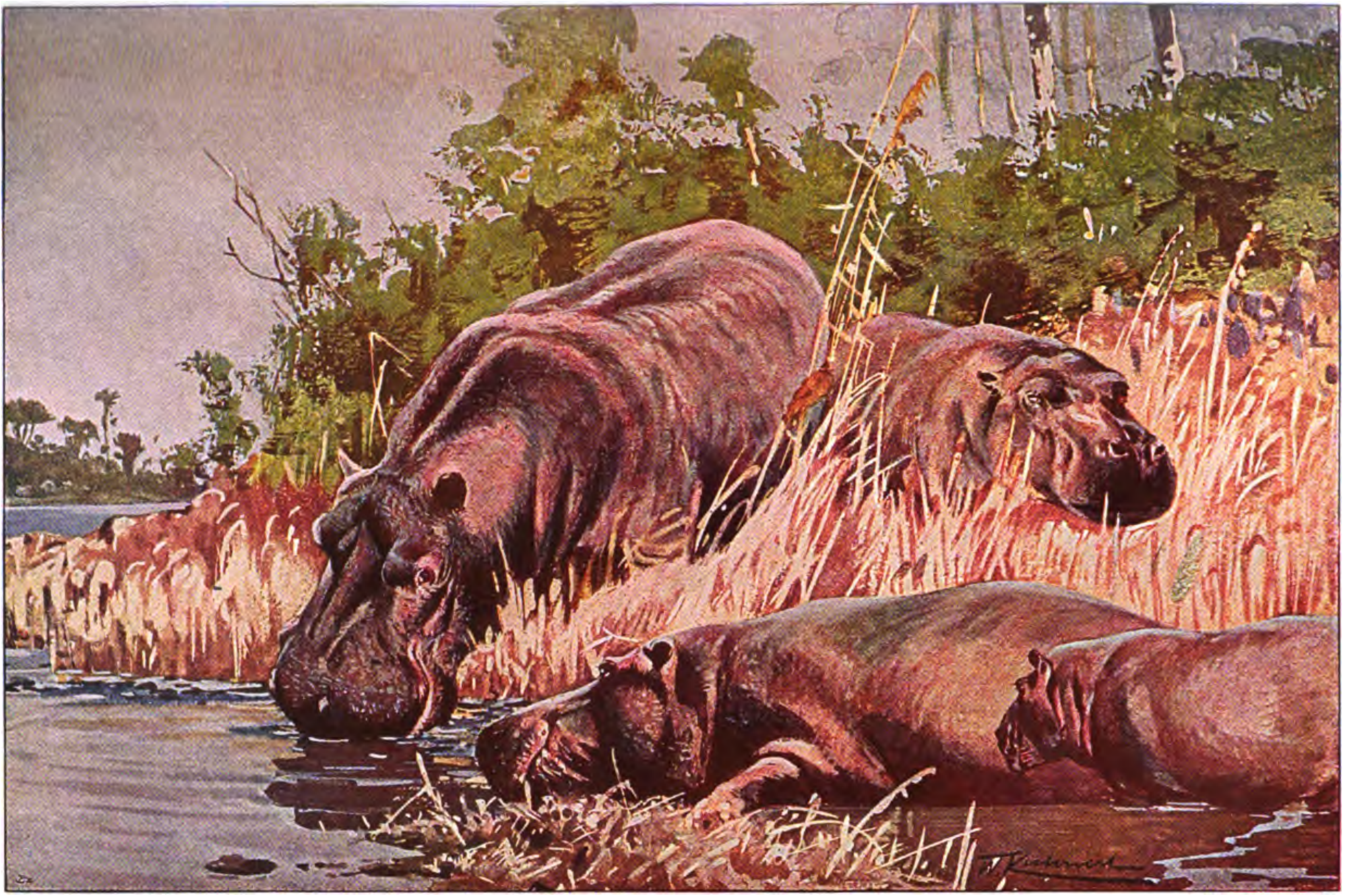

HIPPOPOTAMUS (*Hippopotamus Amphibius*)

afterward. Only fragments of his numerous works remain. Of these, the 'Philosophumena' is the best known, and was first published as a work of Origen's. However, it was soon recognized as a treatise by Hippolytus and first edited as such by Duncker and Schneidewin. In it he states his theological position, dealing especially with heresies and their origins. Hippolytus was also the author of a number of shorter polemical and exegetical treatises. His works are accessible in Migne, 'Patrologia Græca' (Vol. X), and by Bonwetsch and Archelis (Leipzig 1897). Consult Achelis, Hans, 'Hippolytstudien' (Leipzig 1897).

HIPPOPOTAMUS, the generic and popular name of a great amphibious ungulate, allied to the swine, of which two species are known. One (*H. amphibius*) is common throughout the greater part of Africa; the other (*H. liberiensis*) is not only smaller, but has other important differences, and is found only in the African west coast rivers, and those flowing into Lake Tchad. The former species has a thick and square head, a very large muzzle, small eyes and ears, thick and heavy body, short legs terminated by four toes, a short tail, two ventral teats, skin about two inches thick on the back and sides, and without hair, except at the extremity of the tail. A curious feature of the skin is the reddish exudation which pours from its pores when the animal is excited or in pain. It is called "bloody sweat," but the blood has no part in it. The incisors and canines of the lower jaw are of great strength and size, the canines or tusks being long and curved forward. These tusks sometimes reach the length of two feet and more, and weigh upward of six pounds. The animal is killed by the natives partly as food, but also on account of the teeth, their hardness being superior to that of ivory, and less liable to turn yellow. The hippopotamus has been found as much as 14 feet long, and nearly five feet high, but usually measures much less. It delights in water, living in lakes, rivers, and estuaries and feeding on water-plants or on the herbage growing near the water, where it can walk as well as swim. It often leaves the water after nightfall, and goes, sometimes long distances, to grassy pastures to feed; regular paths are worn through the reeds, and here the Africans often arrange pits, deadfalls, or other traps for their capture. These animals are quick of sense, timid and anxious to escape danger; but when brought to bay or enraged prove formidable antagonists and often destroy canoes. They are excellent swimmers and divers, and can remain under water eight or ten minutes. The behemoth of Job is considered to be the hippopotamus. Several extinct species are found in Old World Tertiary formations, and modern species formerly inhabited not only Madagascar, but southern Europe and India, where they were contemporary with the men of the Stone Age.

HIPPURIC (hĭpū'rĭk) **ACID,** an organic acid, $CH_2NH(C_6H_5CO)COOH$, existing in the urine of herbivorous animals, and, in small quantities, in that of human beings. It is increased by a vegetable diet, and by the disease called diabetes, and may be caused to appear in the human urine in considerable quantities by the administration of benzoic acid with the food. It is most conveniently prepared by boiling horse urine with milk of lime, filtering, neutralizing with hydrochloric acid, and evaporating to about one eighth of its volume. The concentrated urine is then acidified with hydrochloric acid and allowed to stand, when impure hippuric acid comes down as a yellowish-brown precipitate. To purify the crude product, it is heated to 212° F. with not quite enough water to entirely dissolve it, and chlorine gas is passed through the solution until the unpleasant smell has entirely disappeared. The solution is then filtered while hot, and the crystals which separate upon cooling are isolated and subjected again to the same treatment, the chlorine being passed through the solution, in this second treatment, until the solution is bright yellow. When thus prepared, hippuric acid crystallizes from water in the form of large prismatic plates, belonging to the trimetric system. Its crystals are colorless or white, free from odor and have a slightly bitter taste. Hippuric acid has a specific gravity of about 1.308, and melts at 369° F.; it begins to boil at about 465° F., giving off benzoic acid and benzonitrile. It is insoluble in benzene, carbon disulphid, and cold chloroform, and is but slightly soluble in ether and in cold water. It is very soluble, however, in boiling water, and in hot alcohol. With bases, hippuric acid forms salts that are remarkable for the beauty of their crystalline forms. When boiled with dilute hydrochloric, sulphuric, nitric or oxalic acid, it yields benzoic acid and glycocoll.

HIRAM, a king of Tyre, who assisted David in the building of his palace. Hiram supplied timber and skilled workmen, and when Solomon succeeded to the throne, gave him similar co-operation in the construction of the temple. Great friendship existed between the two kings, Hiram even supplying a navy to Solomon, when the latter was in need of ships. Tyre was strongly fortified during his reign, and Cyprus was vanquished.

HIRAM COLLEGE, coeducational institution, founded in 1850, in Hiram, Ohio, under the auspices of the Christian Church. It was first called the Eclectic Institute, but was incorporated as a college in 1870. In 1916 there were in attendance about 266 pupils and 20 instructors. There are about 13,000 volumes in the library. It owns six buildings entirely devoted to college purposes, has women's dormitories, a museum, gymnasium and laboratories.

HIROSHIMA, hē-rō-shē'mä, Japan, a town on the island of Hondo, about 160 miles from Kobe, and after Osaka the most important port on the inland sea. It is the capital of the Province of Aki and of the Prefecture of Hiroshima. It is situated opposite the sacred isle of Itakushima, with its celebrated temple. Hiroshima contains several temples and tea houses. It is a centre of the trade in bronze, lacquered ware and other art objects. Pop. 142,763.

HIRSCH, hĭrsh, **Emil Gustav,** American rabbi: b. Luxemburg, 22 May 1852. He studied at the University of Pennsylvania and at Berlin, was rabbi successively in Baltimore, Md. (1877), and Louisville, Ky. (1878–80), and in 1880 was chosen minister of the Sinai congregation of Chicago, Ill. In 1880–87 he was editor of the *Zeitgeist* of Milwaukee, Wis., and later became editor of the *Reform Advocate* of Chicago. He was appointed professor of rabbinical literature in Chicago University in 1892, and was lecturer at Johns Hopkins in 1902. He appeared as an orator on various patriotic and other occasions, and wrote several monographs on religious and Biblical topics. He was also prominent in Republican State politics, and in 1896 was presidential elector-at-large for Illinois. He was in charge of the Biblical department of the Jewish Encyclopædia in 1903–06, and member of the Board of Commissioners of Public Charities of Illinois since 1906. He translated Einhorn's ‘Ritual for Jewish Reform Congregations.’

HIRSCH, Maurice, Baron de (Baron Maurice de Hirsch de Gereuth), Austrian Jewish capitalist and philanthropist: b. Munich, 9 Dec. 1831; d. Ogyalla, Hungary, 21 April 1896. His fortune was computed to be $200,000,000 and his yearly income at about $20,000,000. His benefactions equaled nearly $100,000,000, the most of this sum being directed toward the improvement of the condition of the Jews in all parts of the world. The De Hirsch trust for the United States is a fund of $2,500,000 for the Americanizing and education of Rumanian and Russian Jews. Other large gifts were those of $5,000,000 for the endowment of schools in Galicia and of $50,000,000 to the Jewish colonization association for the establishment of colonies in Argentina. In 1888 he offered to the Russian government $10,000,000 for schools, with the condition that in the distribution of the amount no discrimination as to race or religion be made. This offer was not accepted. Baron de Hirsch made extensive sums through the construction of railways in Turkey.

HIRSCH, Samson Raphael, German Jewish theologian: b. 20 June 1808; d. 31 Dec. 1888. Born in Hamburg of a family devoted to Hebrew studies, and strict conformists, his choice of theology as his vocation was natural and his preparation was thorough. Graduating from Bonn University, his first position (1839) was at Oldenburg and then at Emden (1841). He wrote his ‘Neunzehn Briefe über Yudenthum’ (1826), which was translated into Hebrew (1892) and into English (1899). In 1836 Hirsch issued his ‘Horeb,’ a Jewish text-book for mature young people, followed by two polemical essays against reform. His standpoint from the beginning was orthodoxy and its defense was his *leit motif*. After preaching in Nicolsburg 1846–51, he was called to Frankfort, by the orthodox section of the community, where his activity was developed. He organized a school, founded a monthly and wrote many books. He translated the Pentateuch (1867–78) and the Psalms (1882).

HIRSCHFELD, Georg, German dramatist and novelist: b. Berlin, 11 Feb. 1873. He belonged to the Naturalistic School and during his early career he was hailed by some as a second Hauptmann. He followed closely in the footsteps of Holz and Schlaf, their influence being clearly evident in his dramatic style. He studied in Munich, and while there his first production, a one-act drama, ‘Zu Hause’ (1894), was staged, which is a portrayal of life in Berlin, W. The play which first made Hirschfeld well known was ‘Die Mütter’ (1896), which was produced for the first time by the Freie Bühne in 1895 in Berlin, where Hirschfeld had now come to reside. It proved a success and was then staged by Brahm in the Deutsches Theatre. This is the work by which Hirschfeld is chiefly known. His later dramas are ‘Agnes Jordan’ (1898), a variation of the theme of ‘Die Mütter’; the romantic drama ‘Der Weg Zum Licht’ (1902); the servant's comedy ‘Pauline,’ a counterpart to Hauptmann's ‘Biberpelz’; the artist's comedy ‘Der junge Goldner,’ and one other drama called ‘Nebeneinander.’ At one time in Hirschfeld's career great things were expected of him as a novelist also. ‘Dämon Kleist’ was the first of his stories. It was published in *Die Freie Bühne* in 1894. He had the same admiration for the poetic struggles of Kleist that many other literary men had for Byron. Hirschfeld's mystical genius made a better success of the story ‘Der Bergsee’ (1896). It might be described as the attempt of a naturalist to do homage to symbolistic art. Another story ‘Requiem’ (1906) completes the list of his novels. His last accessible works are two conventional comedies ‘Spätfrühling’ and ‘Mieze und Maria.’ His works are generally characterized by sentimentality and a dreamy poetic longing for beauty and perfection in art. He is still writing and it is impossible as yet to form a definitive judgment of the value of his works. Consult Dr. Adalbert von Hanstein, ‘Das Jüngste Deutschland’; Soergel, A., ‘Dichtung und Dichter der Zeit.’

William F. Hauhart.

HIRTH, hērt, **Friedrich,** German-American educator: b. Gräfentonna, Saxe-Coburg, Germany, 16 April 1845. He studied at Leipzig, Berlin, and Greifswald, entered the Chinese customs service in 1870; retired in 1897, and in 1902 was called to the newly created professorship of Chinese in Columbia University. In 1900 he was consulted by Chancellor von Bülow on the Chinese war indemnity question. In the summer of 1902 he was in Petrograd, cataloguing a collection of manuscripts taken at Peking. He made a valuable collection of Chinese porcelains, now in the museum at Gotha, and one of printed books and MSS, now in the Berlin Royal library. Among his publications are ‘China and the Roman Orient’ (1885); ‘Ancient Porcelain’ (1888); ‘Chinesische Studien’ (Vol. I, 1890); and ‘Ueber fremde Einflüsse in der Chinesischen Kunst’ (1896); ‘Scraps from a Collector's Note-Book, Being Notes on Some Chinese Painters of the Present Dynasty, with Appendices on Some Old Masters and Art Historians’ (1905); ‘Chinese Metallic Mirrors’ (1907); ‘The Ancient History of China’ (1908); ‘Chau Ju-Kua’ (1911), with W. W. Rockhill; and other monographs on Chinese subjects.

HIRUDINEA, bloodsuckers or leeches; formerly classed with flatworms and thought to resemble flukes and tapeworms but really flattened annulate worms (Annelida) with suckers or jaws, and related to the earthworms. Most leeches are carnivorous robbers of the aquatic fauna but some have acquired partial or complete parasitic habits. A few tropical species are land living in Japan, the Philippines, and other eastern regions where they attack travelers or soldiers on the march so violently as to imperil their existence.

HISCOCK, Frank, American legislator: b. Pompey, Onondaga County, N. Y., 6 Sept. 1834; d. 18 June 1914. In 1855 he was admitted to the bar, in 1860–63 was district attorney of Onondaga County, and in 1867 a member of the State constitutional convention of New York. He was a Republican representative in Congress in 1879–87, and obtained recognition as a party leader and speaker. In 1887–93 he was United States senator from New York and chairman of the appropriations committees and then returned to professional practice.

HISPANIA, hĭs-pā'nĭ-ạ. See Spain.

HISSAR, one of the mailed catfishes of northern South America, noted for its monogamous habits, and the fact the eggs, a few at a time, are voided by the female into a pouch made by the folded membranes of her ventral fins. Here they are fertilized by the male, and then are taken by the faithful pair to a secluded place and deposited. This operation is repeated until about 250 eggs are placed in the nest which is then guarded. The hissar and several other species belong to the genus Callichthys.

HISTOLOGY, the science of animal and vegetable tissues. It investigates by means of the microscope the various tissues of man, animals and plants in their anatomical relations and compositions. Topographical histology considers the more minute structures of the organs and systems of the body; normal histology deals with the healthy tissues; and pathological histology investigates the changes they undergo in disease. Marie François Xavier Bichat (1771–1802) is generally credited with the foundation of the science of histology. Unfotunately the imperfect condition of the microscope in his time prevented Bichat and his contemporaries from carrying their investigations to the point which Schleiden, Schwann, Johann Müller, Virchow, Von Recklinghausen, Cohnheim, etc., have reached. It has been found that all structures however complex are made up of cells, and that the parts of a body may be resolved into a small number of elementary tissues now grouped as: (1) epithelium, which lines almost all the cavities of the body and is directly or indirectly in communication with the atmosphere; (2) the nervous tissues, which as nerve cells originate and as nervous fibres transmit all nervous impulses; (3) muscle, which produces motion whether voluntary or involuntary; (4) glandular tissue which consists of cells standing in close relation with the blood-vessels which take from the blood certain substances and secrete them; (5) connective substances which support and hold together the more delicate and important structures, especially forming the cartilages and bones. See Plants, Structure of.

Many tissues have the power of repairing injuries that happen to them. This power is called regeneration, and is found especially in the lower animals, in polyps, worms and in many amphibious creatures and reptiles. In other cases the lesion is supplied by a new growth of connective substance. In diseases the tissues undergo many changes and many of these diseases in the organism are shown also by the changing of color. The science of such changes is generally called pathological histology. It is a comparatively young science and has been cultivated by Virchow, who was the founder of cellular pathology.

Vegetable histology is that department of botany which deals with microscopic phytotomy or the anatomy of plants, especially investigating the plant cells and plant tissues. It is properly subordinate to morphology and is a distinctively descriptive science. It deals with the question in what relation the cells or forms of tissue stand to the vital activity of plants, what functions they perform, and in what respect they are constituted for the fulfilling of those functions. (Compare Cytology). Owing to the excessive minuteness of the cells which form the tissues of all plants the investigation relies almost entirely on the microscope, and naturally has made its advance in proportion as the microscope has been made more perfect. Microscopes that are now used magnify at least 1,000 diameters, and the materials used have to be carefully prepared and mounted. Many of them have to be colored with hæmatoxylin, fuchsin, saffranin, and other alcoholic or aqueous dyes. Consult Bailey, F. R., ‹Text-Book of Histology› (4th ed., New York 1913); Chamberlain, C. J., ‹Methods in Plant Histology› (2d ed., Chicago 1905); Lee, A. B., ‹Microtomist's Vade-mecum› (6th ed., Philadelphia 1905); Strasburger, E., ‹Handbook of Practical Botany› (7th ed., New York 1911); Delafield and Prudden, ‹Handbook of Pathological Anatomy and Histology› (9th ed., New York 1911).

HISTORICAL DETERMINISM. See Determinism.

HISTORICAL GEOLOGY, that branch of the subject that deals with the orderly treatment of the events of the past, chronologically, and with due regard to cause and effect. It includes Paleontology (q.v.) and Stratigraphy (q.v.). See section on *Stratigraphy* in the article on Geology. See also Paleozoic, Cambrian, Carboniferous, etc.

HISTORICAL SCHOOL OF ECONOMICS. See Economics.

HISTORY, ITS RISE AND DEVELOPMENT: A Survey of the Progress of Historical Writing from its Origins to the Present Day.

I. The Nature of History.

1. Meaning of the Term.— The term *History,* in popular usage, has been applied to two somewhat different concepts. It is often used to designate the sum total of human activities, and it is when used in this sense that one often hears the remark at a particularly active or critical period in human events that «now history is being made.» A more common usage is that which regards history as the record of the events rather than as the events themselves. In this latter generally accepted connotation given to the term history, two definitions may be offered. In an objective sense history is, to use the words of Professor Robinson, «all we know about everything man has ever done, or thought, or hoped, or felt.» Subjectively or psychologically expressed, history may be regarded as a record of all that has occurred within the realm of human consciousness.

In this sense of a record of the activities of the human race, history has been regarded by some, particularly in earlier periods, as primarily an art — a branch of literature. By a continually increasing number of authorities it has tended, however, in its modern form, to be considered as in the main a genetic social science, which is concerned with reconstructing the past thoughts and activities of humanity. In the present article history will be regarded in the sense of a science rather than as an art. It is the thesis of the writer that history can lay no more claim to being an art than any other branch of social science and that while artistic achievement may be desired in history it is quite subordinate in importance to scientific accuracy and constructive thought. In fact, progress in historical writing may almost be regarded as a development from an art to a science. It is this which constitutes the progress from Livy to Ranke or from Herodotus to Gardiner.

2. Fallacy of the Term Pre-historic.— Before the important developments in anthropology and pre-historic archæology, which have done so much to extend our knowledge of human activities in the distant past, it was the conventional practice to limit the term history to a record of those events which were described or preserved in literary remains. Now, however, when archæology tells one much more of certain phases of the early life of man than was once known of even more recent periods through literary evidence, it is no longer accurate nor logical to use the term "pre-historic," unless it is employed to designate that vague and hypothetical period in the beginnings of human development of which there exists no positive and tangible record, or unless one is limiting his conception to history as a branch of literature. In the place of the now generally discarded and discredited term "pre-historic" there has been substituted the concept of "pre-literary history," as descriptive of the records of that period of human development where the information is revealed by archæological rather than literary evidence. In short, it has been agreed that a fundamental fallacy and contradiction is involved in the use of the term "pre-historic" for any period of which there is any considerable record preserved, whether in writing or in the artifacts of daily life. With recent writers "pre-historic" has followed the term "pre-Adamite" into that oblivion of discarded categories which is being continually expanded as an inevitable result of the growth of the knowledge of human activities in both time and space.

It has been deemed inadvisable at this point in the article to discuss the various interpretations of what history means or should be mainly concerned with narrating. It is in great part the task of this whole article to reveal the diverse interpretations of history, and this much debated problem of what history means or has been thought to mean will be shown in its historical mutations and transformations.

II. THE ESSENTIAL PRELIMINARIES TO THE ORIGIN AND DEVELOPMENT OF HISTORY.

1. Archæology as the "Threshold" of History — Pre-literary History.— Having seen that history in the modern sense of the term goes back to the beginnings of any record of human existence and activities, one must look for the ultimate origin of history in those early artifacts which were sufficiently distinctive in form and durable in material composition to have been preserved through the ages as evidence of what mankind was accomplishing in the vast expanse of time before the art of writing was mastered. History, thus, may probably be said to have had its real origin in the disputed eolithic period, and the first historical document may be accurately held to have been the first indisputable eolith, or if the eolithic period be denied, the first definite paleolith of the river drift period.

Space does not here allow even the briefest résumé of that most interesting story of the early development of mankind as revealed by the artifacts which have been preserved. The thrilling evidences of man's interests and activities in that almost inmeasurable period of a quarter of a million years which are revealed by the "coup de poings" of the river drift period, the remarkable flaked flints of the cave period, as well as the engraving on animal bones and the early paintings from such sites as Altamira and Font-de-Gaume and the wonderful products of the bronze and iron ages, are all subjects of the most compelling interest, for the complete treatment of which the reader must be referred to the article on "Archæology." Suffice it to say at this point that these archæological products of the pre-literary period mark the real threshold of history.

Nor can one, in the space, allotted to this article, do more than to refer to the origin in modern times of the science of pre-historic archæology, so inextricably connected with the work of such men as Boucher de Perthes, Sir John Evans, de Mortillet, Rutot, Dechélette, Cartailhac, Breuil, Schmidt, Obermaier, Montelius, Peet, Schliemann and Sir Arthur Evans, and which has rediscovered what is, from the standpoint of the time which elapsed, the greater portion of human history. Even less can be said concerning the work of geologists like Lyell, Le Conte, Winchell, Sollas, Geikie, Penck and Chamberlain; of biologists such as Darwin, Wallace, Huxley and Haeckel; and of anthropologists of the type of Tylor, Avebury, McLennan, Morgan and their more critical successors, all of whom have reconstructed the prevailing notions of the origin of the human race, of chronology and the eras of human development earlier fixed by Julius Africanus, Eusebius, and Jerome, and have made it possible for the present generation to interpret the real significance of the archæological remains, rather than being compelled to view them in the manner of earlier generations as "thunder stones," or some other object of fancy and superstition.

2. The Mastery of the Art of Writing.— Though the non-literary archæological remains of early man are of the utmost aid and importance in reconstructing his modes of life and activity, no extensive or ample record of past events was possible until some progress had been made in the way of being able to give uniform objective and permanent expression to human thought and action, in other words, until the art of writing had been mastered.

The obscure origins of the art of writing must be regarded as dating back to the picture writing which first appears on the implements and the cave walls of the middle and later paleolithic periods. Before these pictograms, however, could be regarded as real writing, it was necessary that they should pass through three well defined stages of development. In the first place, the pictures had to become conventionalized, so that they always had the same appearance and designated the same object. Next, it was necessary that they should not only refer to a concrete object, but also become the symbols of abstract conceptions. Finally, it was essential that the conventionalized symbols should pass into that stage where they combined a representation of an abstract conception and the sound of the human voice. This last stage itself passed through a number of developments. In the simplest and most elementary form of this «sound writing» each symbol represented an entire word. Some languages, such as the Chinese, have never passed beyond this monosyllabic stage. Normally, however, the symbols usually came to represent not a whole word but a syllable. Sooner or later, the various possible sounds of the human voice were analyzed and came to be represented by separate symbols or letters, and the alphabet thereby came into existence. The first known example of a true alphabet appeared among the Phoenicians about 1000 B.C. Of its origins little is known further than that the Phoenicians borrowed most of these signs from their neighbors in Egypt, Babylonia and Crete. The Phoenician alphabet contained twenty-two consonants and it remained for the Greeks later to perfect the modern alphabet by adding the vowels. There seem to have been at least five independent centres of the origin of writing, namely, Crete, Egypt, Mesopotamia, China and Central America.

Along with the mastery of the art of writing went the provision of materials on which to set down the desired letters and words. Stone columns and walls and even the clay tablets of the Babylonians, whatever their virtues from the standpoint of permanence, were clumsy, awkward and restricted writing materials. The Egyptians solved the difficulty by utilizing the membrane of the papyrus reed. Later, parchment was fashioned from the skin of animals for the use of those peoples where papyrus was not available. Paper, made originally from silk, first appeared among the Chinese about 200 B.C. The Arabs devised a paper made from cotton fibre, about 750 A.D. This was brought into Spain, where flax was substituted for cotton and the modern linen paper came into use about 1250. With the provision of an alphabet and writing materials, historical writing could begin that long course of development which was to bring it from Herodotus and Thucydides to Ranke, Aulard, Gardiner and Osgood. Professor Breasted has well stated the importance of this step in the evolution of civilization in general and of historical writing in particular, «The invention of writing and of a convenient system of records on paper has had a greater influence in uplifting the human race than any other intellectual achievement in the career of man. It was more important than all the battles ever fought and all the constitutions ever devised.» Before a true historical perspective could develop, however, it was indispensable that some method of measuring time should be discovered and a scientific system of chronology evolved.

3. The Development of the Conception of Time and the Provision of a Chronology.— Indispensable as some method of measuring time was for chronicling the thoughts and actions of man, it was not for this purpose that the calendar was originally developed. As Professor Shotwell has remarked, and Professor Webster has shown in greater detail, it was the deeds of the gods and not of men that the early calendars were designed to fix and record. The methods of measuring time grew up about the need for determining the dates of tabooed or holy days and for fixing and recording the occurrence of unusual natural phenomena which were believed to have some religious significance. In other words, the concept of time was born with the dawn of the consciousness of the repetition of natural processes and phenomena and the necessity of differentiating between days on the basis of their particular virtue or qualities. The perfection of the methods of measuring time has been a gradual process of transition «from luck to mathematics.» It was not until long after crude calendars had been provided for these religious uses that they were utilized to fashion a chronology for recording historic events.

The simplest and most primitive type of calendar was the lunar calendar based on the phases of the moon. The basis was the lunar month of 29 and one-half days. From this it was possible to provide roughly for convenient units of measurement, both longer and shorter than the month. The lunar fortnight was a widespread unit of time, and weeks were secured from the quarters of the moon or from a division of the months into three periods of 10 days each, the latter being closest mathematical solution. Twelve lunar months produced a lunar year of 354 days, and to keep the months synchronized with the seasonal divisions, a thirteenth month was interpolated at appropriate intervals. A longer interval was the lunar cycle of about 19 years, which came into use among the Greeks about 750 B.C. Though the lunar calendar provided no exact divisions of time, either long or short, and was continually getting out of adjustment, it was tolerated and retained by all the peoples of antiquity except the Egyptians, who share with the aboriginal inhabitants of Mexico the honor of having first evolved the solar year and the beginnings of the modern calendar. The agricultural life of the dwellers in the Nile valley and the importance of the Sun-God in Egypt tended to increase the importance of the sun at the expense of the moon. Accordingly, as early as 4241 B.C., the earliest fixed date in history, the Egyptians had devised a solar year of 365 days, with 12 months of 30 days each and five feast days at the end of each year. The seven-day week of the modern calendar, cutting through both month and year, was the product of the ingenuity and religious arrangements of the Hebrews. As early as 238 B.C. Alexandrian scientists had devised the quadrennial leap year, and during the Hellenistic period the Hebrew week was adapted to form the planetary week of the modern calendar. In 46 B.C. Julius Cæsar prescribed for the Roman world this solar year, but the planetary week did not come into general use in Rome before the 2d century A.D. The final step in perfecting the calendar was taken by the authority of Pope Gregory XIII in 1582.

Eleven days were dropped from the calendar and centennial years were regarded as leap years only when divisible by 400.

The provision of some sort of a crude calendar was an essential prerequisite of systematic history, but the process had to be carried on a step further before the mechanism for measuring and recording time was sufficiently perfected to be of any considerable service to the historian. It was not enough to be able to measure time by the year and its fractions; it was necessary to have some method of identifying successive years, in other words, to provide a chronology. While the Egyptians had an admirable instrument for fashioning a scientific chronology in the astronomical «Sothic cycle» of 1461 years, they made no use of it and never provided a scientific chronology. The earliest Egyptian approximation to a chronology was the annalistic expedient of naming the years by some great event which happened therein. The famous «Palermo Stele» constitutes the earliest remaining record of these year-lists and is supposed, in its original complete form, to have identified the seven hundred years from 3400 B.C to 2700 B.C. An advance in methodology was made when the years were named from the regnal years of a particular king. The only great list of Egyptian regnal years which has been preserved, even in a fragmentary condition, is the precious «Turin Papyrus,» which has to be supplemented by the lists inscribed on the temple walls of the later dynasties. About 275 B.C. Ptolemy Philadelphus commissioned a learned Egyptian priest, Manetho, to collect and translate into Greek all the Egyptian annals and regnal lists. The fragmentary remains of the labors of Manetho have constituted the skeleton upon which modern Egyptologists have reconstructed the chronology of ancient Egypt. The Babylonians never passed beyond the annalistic stage of chronology — namely, the identifying of years by some conspicuous occurrence. A contemporary of Manetho, Berossos, a Babylonian priest at the court of Antiochus II, tried to do for Babylonian chronology what Manetho had done for Egyptian, but to judge from what remains of his work in the fragments of copyists, he seems to have been less successful. A far greater exactness was given to Assyrian chronology by the fact that the years of a given king were identified by the annual appointment of an official known as a *limmu*. As the name of the contemporary *limmu* was given in the notices of events contained in the clay records, the lists of *limmi*, dating from 892 B.C. to 704 B.C., enable the historian to establish with a high degree of accuracy the Assyrian chronology. In the later period of Assyrian and Babylonian history there developed some conception of an «era,» which dated from the reign of Nabonassar, 747 B.C. The Hebrew chronology never developed further than the crude genealogical system of reckoning by generations, the conventional length of which was 40 years. Some vague conception of eras seems also to have arisen, as, for example, the period from Abraham to David, or from David to the «captivity.» The classic examples of the Hebrew chronological system are to be found in the opening of the first book of Chronicles and in the first chapter of Matthew. The early Greek historians, in spite of an admirable starting point for the Greek era in the semi-mythical siege of Troy and an unusually ingenious mechanism for measuring time in the «Cycle of Meton,» did no better than their predecessors in creating a chronology. Down to the middle of the 5th century B.C. the only chronological records possessed by the Greeks were the local genealogies and the names of archons, priests and priestesses. The early attempt of Hellanicus of Lesbos, in the latter half of the 5th century B.C., to fashion a chronology from genealogies and name lists has been described by Bury as «an ingenious edifice erected on foundations that had no solidity,» but even the attempt had some significance. Neither Herodotus nor Thucydides made any attempt at solving the problem of chronology, and the later Greek historians finished their work with no more satisfactory system of chronology than the clumsy method of reckoning by Olympiac years introduced by Timæus about 300 B.C. The Olympic «era» was dated from the alleged Olympic games in 776 B.C. The laudable effort of Eratosthenes, about 80 years after Timæus, to put Greek chronology on the firm basis of astronomical measurements was little utilized or encouraged by the historians, though the astronomical researches of the Alexandrian scientists were of the utmost importance for the future of chronology. The practical minded Romans were the first people of antiquity to devise a rational and reliable system of chronology. They dated their years from the mythical foundation of Rome in 753 B.C. The monstrosities of the Christian chronology introduced by Julius Africanus, Eusebius and Jerome, as well as the real foundations of modern scientific chronology with Scaliger's 'De emendatione temporum' and Dom Clément's 'L'Art de vérifier les dates' will be dealt with later. It is sufficient here to bear in mind the fact that only the Roman chronology enabled an historical writer of antiquity to deal with assurance with anything save contemporary history. This serves in part to explain why the great historical works of Greece were strictly in the field of recent and contemporary history. Now that the development of the indispensable prerequisites of historical writing has been briefly touched upon, attention may be turned to the origins of historical writing in antiquity.

III. ORIENTAL BEGINNINGS OF HISTORICAL WRITING.

While the climatic conditions have made Egypt a veritable archæological museum, or, as Professor Breasted has termed it, «a vast historical volume,» and have made possible the preservation of very valuable and extensive sources of historical information in the remains of the architecture, the engineering feats, the plastic art, and even the inscriptions cut on the stone surfaces of tombs, palaces, temples and monuments, there have been few or no Egyptian historical writings preserved. With the exception of a few fragmentary *annals*, such as the «Palermo Stele» no native Egyptian historical writings have been discovered except the garbled and incomplete work of Manetho referred to above. One may safely agree with Professor Hall that «no real historian is known to us in Pharaonic Egypt, nor is it likely that one will ever be discovered.»

While the true historical narrative can scarcely be held to have originated with the Babylonians or Assyrians, they certainly made a closer approximation to this achievement than the Egyptians. The earliest historical writings of the Babylonians, dating back to the third millenium B.C., were the votive inscriptions, giving the names of the kings, their genealogies and a record of the buildings they erected. The great cylinder inscriptions of Gudea (2450 B.C.) are a valuable source for the contemporary manners and customs, while the Code of Hammurabi (2150 B.C.) is probably the most important single document in the history of jurisprudence. In the period following Hammurabi there were important writings of the kings setting forth their achievements, but in an epic rather than a truly historical manner. The second Babylonian kingdom of the 6th century B.C. contributed some important *chronicles* epitomizing some much earlier narratives, which are now preserved only in fragments, and lists of the Babylonian kings. While the Babylonians were concerned mainly with the arts of peace, the Assyrians dealt primarily with the feats of war in their annals and campaign and votive inscriptions. A most important historical document, ascribed by some to Babylonian and by others to Assyrian sources, is the 'Synchronous History,' compiled in the 8th century B.C. This describes the successive boundary disputes between Babylonia and Assyria from 1600 to 800 B.C., with a list of the kings who participated. Finally, from Assyrian sources there are the above mentioned lists of *limmi* or the *eponym canon*, covering the period from 892–704 B.C. The Babylonian counterpart of Manetho's work, Berossos' history of Babylonia in three books, written about 280 B.C., was the first systematic historical narrative produced by a Babylonian or Assyrian scribe. It has, unfortunately, been lost and only survives in scanty references in Josephus, Eusebius and a few other later historians. Whatever its value, its date shows that real historical narrative was not a product of the period of the height of either Babylonian or Assyrian culture.

The honor of having first produced a true historical narrative of considerable scope and high relative veracity must be accorded to the Hebrews of ancient Palestine. The conventional assumption of the Mosaic authorship of the Pentateuch and the synchronous nature of its books, questioned by Hobbes in 1651 and by Spinoza in 1670, was riddled by the French physician, Jean Astruc in 1753, and the German theologian, Karl David Ilgen in 1799. The true nature of the composite authorship of the Pentateuch and the widely divergent dates of the composition of its various books were established as a result of the work of a number of courageous and brilliant scholars, the most prominent of whom were Professor De Wette of Jena, Professor Hupfeld of Halle, Professor George of Berlin, Bishop Colenso of Natal, Professor Kuenen of Leyden, Professor Robertson Smith of Cambridge, Professor Bacon of Yale, and, above all, Professor Julius Wellhausen of Greifswald and Göttingen. Their labors have revealed the fact that the Pentateuch was the work of some five different authors, or groups of authors, writing between 900 and 450 B.C., their diverse writings were consolidated in the Pentateuch, as it is now arranged, some time before 400 B.C. The oldest, or «Jahvist» source, was written about 900 B.C., the next, or «Elohist,» about 725 B.C., the third, or «Deuteronomist,» from about 700 to 620 B.C., the fourth, or «Holiness Code,» about 575 B.C., and the last, or «Priestly Book,» about 450 B.C. Their union, upon the fifth source as a basis, was accomplished some time in the 5th century B.C. The beginnings of the historical narrative among the Hebrews were stimulated by the great expansion of Hebrew prosperity and prestige under Saul, David and Solomon. As Professor Moore has said, «the making of great history has often given a first impulse to the writing of history, and we may well believe that it was so in Israel, and that the beginning of Hebrew historical literature, in the proper sense of the word, was made with Saul and David.» This origin of Hebrew historical writing, which marks the earliest appearance of true historical narrative of which any record has been preserved, is to be found in the work of the unknown author of the «Jahvist» sources of the Pentateuch, Joshua, the Books of Samuel and the opening of the first Book of Kings. Of the labors of this writer, who, though he can claim the honor of being the first of the line of true historians, is known only to students by the recently acquired appellation of «J,» Professor Breasted makes the following comment, «they are the earliest example of historical writings in prose which we possess among any people, and their nameless author is the earliest historian whom we have found in the early world.» The «Jahvist» narrative reaches its highest point in 2 Samuel, ix–xx, which is probably the best example of both Hebrew and Oriental historical writing. Of this passage Edouard Meyer says: «It is astonishing that historical literature of this character should have been possible in Israel at this time. It stands far above everything which we know elsewhere of ancient Oriental historical writing.» The remaining historical books of the Old Testament Canon were the Books of Kings, which were written about 575 B.C., and Chronicles — Ezra — Nehemiah, written about 300 B.C. The Books of Kings were the first practical illustration of Polybius', Dionysius of Halicarnassus' and Lord Bolingbroke's view of history as «philosophy teaching by example,» for the author sought primarily to convince his people by historical illustrations of the disasters that had come to the Hebrews by deserting their national religion. Chronicles-Ezra-Nehemiah constitute the work of a single author, who by genealogies and narrative surveys the whole of Hebrew history with the aim of glorifying through tremendous exaggerations the splendor of the Hebrew kingdom under David and Solomon, and of re-emphasizing the warning of the author of Kings respecting the penalty of deviation from the true religion. Both Kings and Chronicles-Ezra-Nehemiah are distinctly inferior to «J» from the standpoint of accuracy and lucid narrative. One of the greatest products of Hebrew historiography is a work, which, for some curious reason, has not been included in the Protestant canon of the Bible — the first Book of Maccabees. This narrative, written about 125 B.C. by a devout and vigorous Sadducee and an ardent admirer of the Asmonean house — a sort of a Judean Treitschke — tells the stirring story of Hebrew history from the conquest of Palestine by Alexander the Great to the accession of John Hyrcanus. The work centres about the deliverance of Palestine from Syrian domination through the military exploits of Judas Maccabæus and his successors. While fired by the thrills of patriotic pride, the author produced a unique work for his time, in that he explained the victories of the Hebrews as having resulted from the personal ability and courage of the Asmoneans and not from the direct intervention of the Deity in behalf of the Jews. Unfortunately, however, the Christian historians of mediæval Europe took as their Hebrew model not the brilliant secular narrative of First Maccabees, but sought to strengthen their followers' zeal and to terrorize their opponents by imitation of the more conventional Hebrew tales of the miraculous interposition of the Deity in rewarding the faithful and punishing the sinner. The last of the distinguished Hebrew historians was Flavius Josephus (c. 37–105 A.D.). He was the national historian of the Jews and, writing after the destruction of the power of his people in 70 A.D., he tried to compensate for the contemporary distress of the Jewish people by emphasizing the glories of their past. Consequently, he almost outdid the author of Chronicles-Ezra-Nehemiah in his exaggeration of the wealth, population and international prestige of ancient Palestine. His two chief works were the 'War of the Jews' and the 'Antiquities of the Jews.' In his treatment of the Old Testament period his narrative is highly unreliable, but the discussion of the post-Maccabean era is a most valuable source of information, though not wholly free from exaggeration and credulity. He wrote in Greek with a considerable degree of literary skill and he has been referred to as the «Livy of the Jews,» but, while the comparison is not without some basis, Josephus did not equal the national historian of Rome in either literary merit or in accuracy of statement. Though the Hebrews brought into being the historical narrative, Hebrew historiography did not affect the general current of the development of historical writing until after the Christians had taken over the sacred books of the Jews and used them as the basis, not only of much of their theology, but also as the foundation of their chronology and their synthesis of the history of the past. It is to the Greeks that attention must be turned in describing the chief source of the origins and development of the type of historical writing which dominated classical antiquity and prevailed to the time of Julius Africanus, Orosius and Eusebius.

IV. HISTORICAL WRITING AMONG THE GREEKS.

1. The Intellectual Setting of the Origins of Greek Historiography.— The birth of historical writing in Greece required several essential conditions which did not exist before the 6th century B.C., namely, the writing of prose, the critical rejection of the current mythology concerning Greek origins and the stimulation of interest in social origins and institutions. By the middle of the 6th century these indispensable prerequisites of history had come into being in the city of Miletus in Ionia. Cadmus of Miletus, at the beginning of the 6th century, had introduced the practice of writing prose instead of poetry and ranks as one of the earliest of Greek prose writers or *logographoi*. At the same period there was coming into existence that speculative Ionian philosophy to which the world owes the origin of free thought and critical philosophy. As Professor Bury has said, «Our deepest gratitude is due to the Greeks as the originators of liberty of thought and discussion. Ionia in Asia Minor was the cradle of free speculation. The history of European science and European philosophy begins in Ionia. Here in the 6th and 5th centuries B.C. the earliest philosophers by using their reason sought to penetrate into the origin and structure of the world. They began the work of destroying orthodox views and religious faiths.» Finally, the Persian absorption of Ionia tended to break down the provincialism of the Ionian Greeks, through that all-important factor of the contact of cultures, and to arouse their interest in the civilization of the diverse peoples who dwelt in the great empire of which they had recently become a part. The origin of Greek historical literature, then, was a part of that great intellectual movement conventionally known as the rise of the *logographoi* and of the critical Greek philosophy in Ionia. To these more general or cultural explanations of the appearance of the first Greek historical literature, there should be added the personal impulse from the dominating desire of the more prominent citizens of the time to link up their families with a distinguished genealogy. Hesiod had favored the Greek gods by providing them with a respectable ancestry, and a similar service was rendered to the nobles by the *logographoi*.

2. The Origins of Greek Historiography.— In view of the foregoing sketch of the intellectual environment of early Greek critical prose, it seems but in the natural course of events that the first Greek historian should have been Hecatæus (born 550 B.C.), a native of Miletus, the birthplace of both Greek prose and Greek critical philosophy. His main significance lies in the fact that he foreshadowed two significant developments of scientific historical method by setting up truth as the ideal of his statements and by assuming a frankly critical attitude toward the conventional Greek creation myths. The opening paragraph of his 'Genealogies' is the first approximation on the part of any writer to a consciousness of the function of historical criticism, «What I write here,» he said, «is the account which I considered to be true; for the stories of the Greeks are numerous, and in my opinion ridiculous.»

The influences which had produced Hecatæus grew more powerful and the necessary developments between his 'Genealogies' and the 'History' of Herodotus were rapidly consummated. Charon of Lampsacus and Dionysius of Miletus compiled histories of Persia during the middle of the 5th century and Scylax of Caryanda produced the first historical biography. In the latter half of the 5th century Antiochus of Syracuse composed the first history devoted to the peoples of Greece, and Hellanicus of Lesbos opened the way for Herodotus by the breadth of his interests. He not only covered the history of Persia and Greece from a broad social point of view, but also was the earliest of the Greek historians to recognize the necessity of a comprehensive system of chronology and to attempt to supply it.

3. The Systematic Historical Works of Greek Writers.— The first, and in the estimate of modern exponents of «Kulturgeschichte,» the greatest of the systematic Greek historians was Herodotus of Halicarnassus (c. 480–425 B.C.). By his interest in geography and in the civilizations of the East he gave evidence of his Ionic antecedents, while by his dominant concern with the Athenian democracy he gave proof of the transfer of historical attention to Hellenic society. His 'History' was a narrative of Græco-Asiatic relations and contacts from the reign of Crœsus of Lydia (560–546 B.C.) to the defeat of the Persian invasion in 478 B.C. The central theme was the destruction of the forces of Xerxes by the Greeks. But his work was not like that of his great successor, Thucydides, narrowly political and military. It was the story of the struggle of two fundamentally opposed types of civilization, and to prove this antagonism, Herodotus surveyed the foundations of these two cultures to locate the deeper causes of the conflict. It combined, thus, the characteristics of a «Kulturgeschichte» and a «Weltgeschichte,» though both were strictly limited in point of time. An ardent admirer of Athenian «democracy» he eulogized Athens and its triumph over autocratic Persian imperialism with the epic fervor of a Bancroft. While recognizing and stating the fundamental principles of historical criticism, he often deserted them, especially in his credulity in accepting the tales he heard on his travels. On the whole, however, modern historical, archæological and ethnographic research has tended to confirm rather than to discredit his statements, and no subsequent historian has been more keen or sympathetic in his analysis of human nature. As the scope of history has been broadened in recent years through the reassertion of the value and position of «Kulturgeschichte,» the slogan has come more and more to be «back to Herodotus» rather than «back to Thucydides,» as was long so popular.

As much as subsequent historiography owes to Herodotus with respect to an illustration of the proper scope of history, it is equally indebted to Thucydides (c. 465–396 B.C.) for contributions to the methodology of historical research and to the construction of a coherent historical narrative. His theme, the Peloponnesian War (431–404 B.C.), was as much more narrow and restricted a field than that covered by Herodotus as the American Civil War would be as compared with the evolution of civilization in the 19th century. As his history was in part prepared by Thucydides during the course of the conflict, it was the work of a scholarly and philosophic war correspondent — an antique Hilaire Belloc — rather than of the dispassionate historian reconstructing the events of a distant past from a study of the documents. His sketch of the rise of Greece shows, however, that he had rare power in portraying the past if he had seen fit to utilize it. His greatest contribution to historiography was in the field of criticism and methodology. He set forth with great vigor the thesis that the permanence and enduring fame of an historical work should depend rather upon the accuracy of the statements than upon the entertainment furnished by the narrative. Ranke, at the opening of the 19th century, did not state more effectively than Thucydides had at the close of the 5th century B.C., that accuracy of data was the foundation of history. The second great historical canon of Thucydides was «relevance» of material, something widely at variance with the long and numerous digressions of Herodotus. To these should be added his ability in the mastery of details and their subordination to the movement of the whole narrative. In these respects Thucydides may rightly be held to have been the founder of scientific and critical history. Finally, while Thucydides has received much credit in this respect which really belongs to Polybius, he was probably the first historian clearly and definitely to state the alleged «pragmatic» value of the writing and study of history. In the opinion of Thucydides, «the accurate knowledge of what has happened will be useful, because, according to human probability, similar things will happen again.» Though his writings must not be judged by the canons of Lamprecht's Historical Institute, the Sorbonne or L'École des Chartes, they were not free from major defects. He was unable to grasp the concept of time and to view his facts in their true historical perspective. He narrowed the field of history not only to a consideration merely of contemporary political phenomena, but even to the external military and diplomatic phases of political activity. He missed the vital significance of the deeper social and economic forces in history, a weakness perhaps over-emphasized by Mr. Cornford. It can scarcely be doubted, moreover, that he carried the element of «relevance» too far and omitted as much material that was pertinent as Herodotus had included which was not germane to the subject. Again, he illustrated Carlyle's weakness in his dramatic interpretation of events in terms of great personalities, and he did not possess the latter's ability to portray a personality in its entirety. Lastly, there appeared little or none of Mabillon's profound discussion of the critical use of documents; his sources were carefully concealed in order that the style of the narrative might not suffer. One may agree entirely with Bury that «the work of Thucydides marks the longest and most decisive step that has ever been taken by a single man towards making history what it is to-day,» without regarding that statement as an unmixed compliment. Thucydides certainly was influential in bringing historiography under the domination of the «political fetish» and the spell of episodes from which it suffered from classical times to the end of the 19th century, and from which it is only now beginning to escape. It must not be forgotten that, as Lamprecht has insisted, historical accuracy means as much the presentation of the complete analysis of an event, period or movement as it does the mere truth of such facts as are narrated. From the standpoint of this broader and more fundamental view of historical accuracy Thucydides will scarcely rank as superior to Herodotus. The ardent admirers of the former have forgotten that scope and content are quite as important in history as refinement of the methodology of research.

An historian far inferior to Herodotus or Thucydides was Xenophon (c. 430–354 B.C.). His literary ability was of a high order, but his capacity for profound historical analysis was most limited. He was a good memoir writer and his 'Anabasis' was one of the most absorbing of Greek memoirs. In his 'Hellenica' he attempted to continue the narrative of Thucydides from 411 to 362 B.C. While this work is most valuable as an historical source for the period, it is superficial and owes what historical merit it possesses primarily to its imitation of the method and arrangement of the work of Thucydides. On the whole, it is safe to agree with Bury that he owes his reputation to the fact that an uncritical generation later preserved his writings, while allowing more meritorious works to perish and that «if he had lived in modern days, he would have been a high-class journalist and pamphleteer and would have made his fortune as a war-correspondent.» It would not be fair, however, to overlook the remarkable versatility of Xenophon's literary talents, which were exhibited in memoirs, biography, systematic history, constitutional analysis and economic theory.

The last of the major Greek historians was Polybius (c. 198–117 B.C.). From the standpoint of either productivity or profundity he was superior to Thucydides and was fully equal to him with respect to accuracy of statement, but his style being labored and diffuse he has been less popular than his two great predecessors. His 'History' was a vast work in 40 books dealing with the expansion of the Roman Empire to 146 B.C. As Herodotus had mirrored the interest of early Greek historians in the East, and Thucydides had written of Athens at the height of its civilization, so Polybius testified to the decline of Hellas and the shifting of interest to the new empire of the West. His scholarship was equal to that of the great historian of British expansion, but he lacked the latter's power of compression and lucid statement. In the 12th book of his work is found, as a critique of the antiquarian, Timaeus, the first great treatise on the methodology of scientific history. Conceived independently of Thucydides, this discussion has scarcely been surpassed, and his impartiality is a model for all historians. Especially noteworthy was his Ritter-like insistence upon the value of a knowledge of topography to the historian. He intended his history to be intensely pragmatic — to be «philosophy teaching by example,» but he never allowed the philosopher in him to overcome the historian. Greatly interested in the problem of causation, he went deeper in his analysis of impersonal causes than Thucydides, though his interpretation was ethical rather than economic and social. The following brief quotation from his 12th book admirably epitomizes his views as to the scope, methods and purpose of history. «The science of history is three-fold: first, the dealing with written documents and the arrangement of the material thus obtained; second, topography, the appearance of cities and localities, the description of rivers and harbors, and, speaking generally, the peculiar features of the seas and countries and their relative distances; thirdly, political affairs. . . . The special province of history is, first, to ascertain what the actual words used were; and secondly, to learn why it was that a particular policy or arrangement failed or succeeded. For a bare statement of an occurrence is interesting indeed, but not instructive; but when this is supplemented by a statement of cause, the study of history becomes fruitful. For it is by applying analogies to our own circumstances that we get the means and basis for calculating the future; and for learning from the past when to act with caution, and when with greater boldness, in the present.» All in all, one may agree with Professor Botsford that «a careful reading of this author is the best possible introduction to the spirit and method of history as we of to-day regard it.»

4. **Minor Contributions to Greek Historiography.**— Polybius was unique in his age as an historian. Long before he composed his great work Hellenic historiography had begun to decline from the standard set by Thucydides and was brought under the influence of rhetoric in the 4th century. With their tendency to insipid moralizing, the interpolation of florid speeches, and their «passion for panegyrics,» the historical works of the rhetorical school, like those of Froissart and Lamartine «exhibited artistic but not historical genius.» This capitulation to the popular demand for rhetoric Hermann Peter believes to have been the main cause for the decline and stagnation of Greek history and its Roman imitations. Of the «Rhetoricians» of the 4th century the leader was Isocrates and the chief historians of the school were Ephorus and Theopompus. The work of Ephorus was probably the nearest approach in Greek historiography to a «national history» of Hellas. Of quite a different character was the work of Timæus of Tauromenium who devoted a lifetime of labor to the patient compilation of a vast repository of reliable facts concerning the history of Sicily and Italy. He was the first and the greatest of the antiquarians that flourished in the 3d century and he may be regarded as the prototype of Blondus and Mabillon. Two later ambitious compilations — the 'Weltgeschichte' of Diodorus of Sicily (c. 90–21 B.C.) and the Roman history of his younger contemporary, Dionysius of Halicarnassus, were of a far inferior order, though, perhaps, superior to the work of the «Rhetoricians.»

Historical biography among the Greeks was founded by Isocrates, the leader of the «Rhetoricians,» and one of the earliest products was the biography of Agesilaus by Xenophon. Subsequent historians devoted considerable space to biography. Plutarch's (c. 50–125 A.D.) polished 'Parallel Lives' have remained at the head of the world's biographical product on account of their compelling interest, if not for their entire historical accuracy. Indeed, it must be remembered that Plutarch was a moralist and wrote his «Lives» not as strictly historical biographies, but in order to furnish concrete illustrations of his ethical principles for the moral edification of his readers.

In the period of the Hellenic revival in Rome a number of Greek historians made contributions to historical writing of widely different merit. Among the less notable productions were the 'Anabasis of Alexander' by Arrian (c. 95–175 A.D.) and the 'History of Rome' by Appian, in the same period. Far superior to these were the incisive 'History of Rome' of Dio Cassius (c. 155–240 A.D.), and the broadly conceived history of the later Roman empire, in its social as well as its political conditions, by Ammianus Marcellinus (c. 330–401 A.D.), the last of the long and honorable list of Greek historians who, curiously enough, wrote his work in Latin.

V. ROMAN HISTORIOGRAPHY.

Rome added no original contributions to historiography. As in all other phases of its culture, Rome here followed the model set up by the Greeks. While there were distinguished Roman historians, none equalled Thucydides or Polybius for careful adherence to critical method and only Livy and Tacitus approached the best of the stylists among Greek historians.

The immediate dependence of the Roman historiography on the Greek is evident from the fact that down to the 2d century B.C. all the Roman historical literature was even written in Greek. These early historical works in Greek were chiefly 'Annals' of which the first and most famous were those of Fabius Pictor (c. 250 B.C.). The first Roman historical literature in Latin was the 'Origines' of Cato the Censor (c. 234–149 B.C.), in which he narrated the history of Rome interpreted according to his notorious bucolic and aristocratic prejudices. The first real historian among the Romans in point of time was that leader of all Romans in ability, Julius Cæsar (100–44 B.C.). Generally accurate and always clear, forceful and direct in his style, Cæsar's apologies for his public career — the 'Commentaries' and the 'Civil War' were the best historical memoirs produced in the ancient world and rank well with those of any period. A more systematic historian was Sallust (c. 86–34 B.C.) the Roman disciple of Thucydides. His chief work, a history of Rome from 78 to 67 B.C. has never been recovered, but from his monographs on the 'Conspiracy of Catiline' and the 'Jugurthine War' one can appreciate his vigorous and graphic style and his power in the analysis of personalites and social forces, but he was not able wholly to conceal his pessimism with regard to the future of the Roman state in the last years of the Republic. The great national history of Rome was that of Livy (59 B.C.–17 A.D.). His work was a massive epic of the growth of the Roman world-state. While he had a general appreciation of the value of accuracy of statement, he subordinated this element to that of perfection of style, and the Greek «Rhetoricians» rather than Thucydides were his model. The great literary merit of Livy's history, its ministry to the national vanity of the Romans and their cult of modern admirers, and its great popularity with the humanists have given it a position in historiography higher than its purely historical value would warrant. A less successful example of the Roman historical writing of the rhetorical school was the history of Rome under the early empire by Velleius Paterculus in the period of Tiberius. The last of the major Roman historians was Tacitus (c. 55–120 A.D.). Like Polybius, he was a man of action, and, being an ardent admirer of the aristocratic Republic, his view of contemporary Roman society was even more pessimistic than that of Sallust. While he wrote with great vigor, had rare power of portraying personalities and was generally accurate, the subjective moralizing element in his writings, while adding to their literary reputation, greatly reduced their historical value. To him and to Juvenal is primarily due that notorious and venerable myth of the «moral causes» for the decline of the Roman Empire, which was later revived and elaborated with such deplorable results by Kingsley. In addition to his purely historical works — the 'Annals,' the 'Histories' and the biography of Agricola, dealing with Roman history in the 1st century of the Christian era, the 'Germania' was one of the earliest excursions into the field of descriptive sociology. Being the only extensive source of information regarding the institutions of the Germans of that time, the «Germania» has acquired a great importance in later years. It has been the most controverted historical document in existence, excepting only the Pentateuch and the Synoptic Gospels. Recovered in the period of the humanists and brought before the learned public by Poggio, Enoc of Ascoli, and Conrad Celtis, it has been the centre of historical conflict between the modern Teutonist and Gallican historians, as much as Alsace-Lorraine has been the pivotal point in the political and military rivalry of their respective national States. More than this, the tendency of Tacitus to idealize the early Germans at the expense of the Romans originated that humorous but disastrous perversion of the interpretation of the «invasions» which culminated in the vagaries of Charles Kingsley's «The Roman and the Teuton.» The last Roman historian of any repute, unless it be the vague figure that Kornemann has endeavored to reconstruct, was Suetonius (75–160 A.D.), the erudite secretary of Hadrian. His diffuse 'Lives of the Cæsars,' while reliable in its description of public affairs, was one of the earliest examples of historical «muckraking» and «scandal mongering.» His chief significance in historiography lies in the fact that he became the model in style and arrangement for the historical biography of the period of humanism. Though the Roman historians were not original and were always more or less under the spell of the Greek «Rhetoricians,» Roman historiography was incomparably higher in the sphere of reliability than the type which was to succeed it and was to bring historical writing back under the spell of mythology and religious prejudices from which it had escaped with Hecatæus of Miletus eight centuries earlier.

VI. PATRISTIC HISTORIOGRAPHY.

1. The Christian Synthesis of the History of the Past.— One of the most effective agencies in allaying suspicion and attracting converts to a movement is the ability to point to a glorious past. The Christians felt this keenly, and, having adopted the sacred books of the Jews as the official record of their antecedents, they were faced with the immediate and pressing necessity of giving to ancient Hebrew history a prestige which it had entirely lacked in the works of pagan historians, who had assigned to the history of the Jewish people only that slender allotment of space and attention to which their inconspicuous political history had entitled them. Therefore, the two world histories, which had already been produced by Diodorus Siculus and Pompeius Trogus, and which were immensely superior to any universal history compiled by Patristic historians, were utterly unsuited to the requirements of Christian propaganda. Neither was the general Jewish history of Josephus acceptable. for, while it exaggerated tremendously the rôle of the Jews, it was distinctly antagonistic to the Christians. Therefore, the Christian «literati» set about to produce a synthesis of the past which would give due weight to the alleged glories of Hebrew antiquity and would, at the same time, show why the Jews were no longer worthy of their heritage, which had now passed to the Christians. The first writer to essay the task was Sextus Julius Africanus (c. 180–250) who composed a history of the world in five books bringing the story to 221 A.D. In this he tried to harmonize and synchronize Hebrew and Christian history with that of the four great successive pagan monarchies — the Assyrian, Persian, Macedonian and Roman. This was carried further in the 'Chronicle' of Eusebius (c. 260–340), and Jerome was able to find scriptural sanction for this synthesis in the prophecy contained in the last chapters of Daniel. «That long history,» says Professor Burr, «which was now their preamble was the sacred story of the chosen people, with its Jacob's ladder forever linking earth to heaven. The central actor was Jehovah, now the God of all the earth. About that story and its culmination all other history must now fall into place; and from the sacred record — for the record too is sacred — may be learned the plans of the Omnipotent. It was Jerome who now found them in the interpretations and the visions of Daniel — in the image with head of gold and belly of brass, in the four great beasts that came up out of the sea — and from his day on almost to ours the changing empires of earth have been forced to find a place within that scheme. Whatever in non-sacred annals was found in conflict with Holy Writ must be discarded. What was left must be adjusted to its words. Man's career on earth became a fall. Nor might human wit exalt itself: Pythagoras and Plato had learned from Moses; Seneca from Paul.» The Christian synthesis received its great philosophic statement and defense in Augustine's 'City of God' (426). It was finally systematized in the grotesque but fiery 'Seven Books of History directed against the Pagans' (417) of Orosius, which was the standard text on universal history until the revival of the appreciation of pagan culture with the advent of «Humanism,» when it was riddled by the scholarship of Flavius Blondus (1388–1463) and was superseded by the 'Enneades' of Sabellicus (1436–1506), the humanist attempt at a universal history.

An important part of the Christian synthesis was the synchronizing of the events in the history of the Gentile and Hebrew nations and the establishment of an official Christian chronology. The initial step was taken in this process by Julius Africanus in his 'Chronographia.' In this, the period of the creation was set as having occurred 5499 years before Christ, and subsequent events in world history were dated through an ingenious combination of the various systems of chronology used by the different nations. Eusebius expanded the work of Africanus in his famous 'Chronicle,' in which he epitomized universal history in a set of parallel synoptic and synchronous chronological tables giving the reigns of the rulers of the «four great monarchies» synchronized with the events of Hebrew history. «In these tables,» says President White, «Moses, Joshua and Bacchus, — Deborah, Orpheus and the Amazons,— Abimelech, the Sphinx, and Oedipus, appear together as personages equally real, and their positions in chronology equally ascertained.» The chronology of Eusebius was adopted by Jerome in his 'Chronicle,' and in Jerome's version it became the authoritative Christian chronology until it was slightly revised by Scaliger in 1583 and Usher in 1650. It entered systematic church history in the 'Historia Tripartita' of Cassiodorus and was the introduction to every authentic mediæval chronicle.

In this Christian synthesis of world history, aside from the artificiality of its chronology and synchronisms, two characteristics are noteworthy, namely, the absurd relative importance attached to Hebrew history and the serious bias against pagan civilization which made an objective historical narrative absolutely impossible. Of the former tendency Professor Robinson has said, «this theological unity of history was won at a tremendous sacrifice of all secular perspective and accuracy. The Amorites were invested with an importance denied the Carthaginians. Enoch and Lot loomed large in an age which scarcely knew Pericles.» It is a curious but incontestable fact that the Jewish nation owes its prominence in world history to these distortions of the early Christian historians. Always on the defensive in the Patristic period, the churchmen were compelled to answer the charge of having been the cause of the calamities which came to the Roman Empire in the 4th and 5th centuries. The calamities could not be denied, and so the only procedure possible was to prove a greater prevalence of misery before the Christian era. This was particularly the task assigned by Augustine to Orosius and performed with great thoroughness in the latter's above mentioned work. Deliberately shutting his eyes to all the cultural contributions of antiquity, he gathered a veritable «historia calamitatum» by combing pagan history to present an unrelieved picture «of all the most signal horrors of war, pestilence and famine, of the fearful devastation of earthquakes and innundations, the destruction wrought by fiery eruptions, by lightning and hail, and the awful misery due to crime.» «All the achievements of Egypt, Greece and Rome,» says a leading historian, «tended to sink out of sight in the mind of Augustine's disciple, Orosius, only the woes of a devil-worshipping heathendom lingered.» When one remembers that this work was almost the sole source of information during the Middle Ages regarding the history of pagan antiquity, it is little wonder that Blondus could remark in the 15th century, that since Orosius there had been no history. Yet, in spite of the external and conscious bias of the «Fathers» against pagan culture, they could not escape the unconscious sources of influence springing out of their environment of paganism. Thus, by a curious irony of fate, it came about that the classical culture they assumed to abhor actually influenced their cosmic and historical philosophy as much, if not more, than the cultural traditions of Judaism. The «Fathers» used the classical languages and were always under the spell of classical rhetoric; many of them were educated as pagans; their syncretic theology was deeply colored with pagan elements; and their political ideals and practices were so thoroughly modelled after those of the Roman Empire that Professor Burr has very aptly described the origins of the Christian ecclesiastical polity as "the rise of the new Rome." This much is evident from such sources of information as have been preserved. If the great mass of early Christian historical writing which has been lost were available for study it might well be that an even greater amount of infiltration of pagan culture could be detected.

2. The Christian Philosophy of History.— Almost as wide as the break with the classical historiography with respect to the status of pagan culture was the difference in the great emphasis placed on pragmatism and teleology in the Patristic historical literature. To the early Christian historians the "process of history" had a real significance and meaning, it was a part of a greater cosmic process in which God and man were the chief participants. "The Christians were perhaps the first to suspect a real grandeur in history," says Professor Robinson, "for to them it became a divine epic, stretching far back to the creation of man and forward to the final separation of good and evil in a last magnificent and decisive crisis." This Christian philosophy of history, which has been so felicitously termed by Santayana the "Christian Epic," was gradually evolved by the "Fathers" and received its final and decisive systematic expression in Augustine's 'City of God.' This philosophy, drawn more from Persian and Hellenic than from Hebrew sources, considered the historic process as a part — the consequential portion — of a great cosmic struggle between the forces of good and evil. In its earthly and historical significance this conflict was a struggle between the City of God — the community of the elect believers in the Hebrew and Christian God — and the City of Satan — the collective name of the previous and contemporary adherents to paganism. Its final outcome was to issue in the glorious triumph of the former and the utter destruction and discomfiture of the latter. With such a philosophical background it is not difficult to understand that Christian historiography was pragmatic to a degree not dreamed of by either Polybius or Dionysius; it was "philosophy teaching by example" with a real vengeance. With such issues at stake the most insignificant event could not fail to have its vital import. This "epic," which received its philosophical exposition from Augustine, was illustrated from history by Orosius and was given an elegant literary form in the 'Chronica' of Sulpicius Severus (363–423).

3. Historical Method in the Patristic Period.— The Christian historians also departed widely from the canons of historical method laid down by Thucydides and Polybius. In addition to their tremendous bias against paganism, which made objectivity out of the question, it was necessary to devise a special method for handling "inspired" documents. To assume towards the Hebrew creation tales the critical attitude that Hecataeus maintained toward the Greek mythology would have been impious and sinful. Therefore, if the obvious content of the inspired statement was preposterous and unbelievable, some hidden or inner meaning must be found, and, in response to this necessity, allegory and symbolism replaced candor and critical analysis as the foundations of historical method. "Not even Holy Writ," says Professor Burr, "was prized for the poor literal facts of history, but for those deeper meanings, allegorical, moral, anagogical, mystical, to be discerned beneath them." The allegorical method of interpreting the Old Testament had been introduced by the Alexandrian Jew, Philo Judaeus, and appeared in early Christian writings in the Book of Revelations, in "The Epistle of Barnabas" and in "The Shepherd of Hermas." Its main early impulse among the Fathers came from Origen (186–255). According to Origen, says Conybeare, "Whenever we meet with such useless, nay impossible, incidents and precepts as these, we must discard a literal interpretation and consider of what moral interpretation they are capable, with what higher and mysterious meaning they are fraught, what deeper truths they were intended symbolically and in allegory to shadow forth. The divine wisdom has of set purpose contrived these little traps and stumbling blocks in order to cry halt to our slavish historical understanding of the text, by inserting in its midst sundry things that are impossible and unsuitable. The Holy Spirit so waylays us in order that we may be driven by passages which taken in their *prima facie* sense cannot be true or useful, to search for the ulterior truth, and seek in the Scriptures which we believe to be inspired by God a meaning worthy of him." This allegorizing tendency, which vaulted over criticism, was almost universally accepted by the "Fathers" and received its classical expression in the 'Moralia,' or 'Commentary on the Book of Job,' of Gregory the Great (540–604), and the 'Allegoriae quaedam sacrae Scripturae' of Isadore of Seville (d. 636), which gave in chronological order the allegorical significance of all the persons mentioned in the Old and New Testaments. These became standard mediæval manuals on allegory.

Another element which entered into the historical attitude and methodology of the Patristic period was Neoplatonism. With its thesis of the superiority of the emotions and intuition to reason and intellect and its advocacy of "unbounded credulity," it fitted in admirably with the Patristic mental reactions and became an integral part of the psychic complex of the Patristic and mediæval historians and philosophers. Augustine flirted with it in his youth and it loomed large in his later philosophy. Its great mediæval impulse came mainly from the philosophical and literary activities of Erigena. Along with the allegorizing tendency it served to make quite impossible any sceptical and critical attitude towards the sources of historical knowledge.

Not only were these two standards for the use and interpretation of historical documents erected, but there were also delimited two sharply defined fields of history, the sacred and the profane, the first relating to religious and the latter to secular activities. It is needless to remark that an incomparably greater importance was attached to sacred history and that the working of a miracle was considered much more significant than the making of a constitution. The “Fathers” were willing to devote the most extended labor to the allegorical explanation of dubious and contradictory statements in scripture, but it is impossible to imagine one gathering and analyzing the contents of 158 constitutions. It is only fair to state, however, that the evident decline of historical scholarship in the Patristic period cannot be wholly assigned to the Christian attitude towards historical data and problems. Though there were the reasons enumerated above why the Christian historiography was bound to be less sound than its pagan counterpart, it cannot be denied that the period of the “Later Roman Empire” was one of general intellectual decline, and the lapse of the ideals of the height of classical culture affected pagan, as well as Christian, writers.

4. Systematic Ecclesiastical History in the Patristic Period.— The most creditable performances in the realm of Patristic historiography were achieved in the field of systematic history of the Christian Church. Though the ‘Weltanschauung’ of the writers marred their perspective and warped their interpretation, the resulting damage to historical scholarship was least in this department. While the anti-pagan bias, the lust for the miraculous, the pious credulity of the writers and the Christian philosophy of history were all in evidence, the very nature of the subject made their operation less disastrous here than in the synthesis of the history of antiquity; attention was centered almost entirely upon ecclesiastical matters and the writers dealt in a large degree with their co-religionists of the immediate past who scarcely received the reverence accorded to personages who had figured in scriptural events — the Church Fathers, like the makers of the American constitution, were not always canonized by their own generation.

The earliest semi-narrative sources of the history of the foundations of Christianity are to be found in the ‘Epistles’ of the 1st century and in the ‘Synoptic Gospels,’ written probably in the last quarter of the century. Of the former, the most important, naturally, are those of Paul, the great organizing missionary and theologian of the early Church. Of the Gospels, the earliest and most reliable is the straight-forward narrative of Mark, written about 70 A.D. The ‘Acts of the Apostles,’ the remaining canonical historical work of the Apostolic period, was written by the author of Luke about 100 A.D. The “Apologists” of the 2d and 3d centuries are also valuable sources of information, though their writings were highly controversial. The first, and the most erudite and scholarly systematic ecclesiastical history of the Patristic period was the work of Eusebius of Caesarea (c. 260–340). His ‘History of the Christian Church,’ which, in 10 books, brought the story to 324, was a work of massive erudition and relatively high impartiality, but was compiled without literary skill and was most superficial in its analysis of the underlying causes of the great social and religious movements. Though he was not a profound thinker, Eusebius was a real scholar and the literature he examined in the execution of his work was enormous. Many of the most important documents he used were copied *in extenso* in his history; this makes the work a most valuable source book which contains the only extant portions of some highly important early Christian writings. A vast gulf exists between the level of the histories of Eusebius and Orosius.

The ‘History’ of Eusebius was continued by the historians Socrates, Sozomen and Theodoret in the 5th century. The whole was combined and translated into Latin under the direction of Cassiodorus (477–570) in the 6th century, and the narrative was continued to 518. This product of Cassiodorus and his disciples, known as the ‘Historia tripartita,’ was the general manual of church history throughout the middle ages. Though confused, incoherent, inaccurate, and annalistic, it was certainly superior to the companion text-book on secular history by Orosius. The greatest defect in the early Church histories was their failure to analyze the deeper forces and the more significant events in the great religious movement which they were describing. This was due in part to the belief that Christianity was being advanced through divine favor and in part to the fact that the writers all succumbed to the temptation to treat primarily of wonders, miracles, martyrs and saints.

Christian biography was founded by Jerome's ‘De viris illustribus,’ a brief sketch of the lives of all who had contributed to the body of Christian literature, and by the biographies of the earlier saints and hermits. Jerome's work was continued by Gennadius (c. 495), a priest of Marseilles, and by Isadore of Seville in works of the same title. Isadore's compilation was, in turn, supplemented by that of Ildephonsus of Toledo (d. 667), and the process of addition continued through the mediæval period to culminate in the collection of 963 biographies in the ‘Liber scriptorum ecclesiasticorum’ of Johannes Trithemius (1462–1516), abbot of Sponheim. The astonishing credulity of even the most learned of these early biographers, and their zeal for “miracle-mongering” can best be appreciated by a perusal of such a work as Jerome's ‘Life of Paul the First Hermit’ or Athanasius' ‘Life of Saint Anthony.’

VII. HISTORICAL LITERATURE IN THE MIDDLE AGES.

1. Its Relation to Patristic Antecedents.— It will be evident from the foregoing discussion that Orosius and Cassidorus were the standard historical authorities for the Middle Ages and that there was no break with the Patristic philosophy of history or historical methods. “The Middle Ages,” says Professor Burr, “did not dissever history and theology. Nay to forbid it there grew to completeness that consummate preserver of the unity of thought, the procedure against heresy. And to the end of that long age of faith history did not escape the paternal eye.” The chief representatives of historiography in the Middle Ages, as of other phases of mediæval culture, were churchmen of one sort or another. The same zeal for the miraculous and diabolical and disregard of such non-essential “commonplaces” as the foundation and disruption of states and epoch-making political, economic and social movements still persisted unimpaired. The “Christian Epic” kept its prestige unshattered and almost unchallenged for 14 centuries, disturbed only slightly by the 13th century “revival,” the growth of humanism and the controversies of the Reformation period. It never received its first staggering blow until, in the 18th century, the English and French «Deists» and «Philosophes» revealed its weaknesses and inconsistencies by their penetrating and disconcerting criticism. If anything, in at least the first centuries after the close of the Patristic period, there was a decline in scholarship. The mediæval writers not only retained the Patristic defects but added to them the absence of the great erudition of many of the «Fathers» and the presence of those crudities incident to a recent emergence from barbarism. This assimilation of the Patristic outlook and methodology and its adaptation to mediæval capacities was primarily the work of Rhabanus Maurus (776–856), his pupil and disciple, Waiafrid Strabo (c. 809–849) and John Scotus Erigena (d. 877). Heinrich von Sybel thus summarizes the outstanding characteristics of mediæval historiography in a manner which brings out clearly its close relation to Patristic historical literature: «This period possessed no idea of historical judgment, no sense of historical reality, no trace of critical reflection. The principle of authority, ruling without limitation in the religious domain, defended all tradition, as well as traditional dogma. Men were everywhere more inclined to believe than to examine, everywhere imagination had the upper hand of reason. No distinction was made between ideal and real, between poetical and historical truth. Heroic poems were considered a true and lofty form of history and history was everywhere displaced by epics, legends or poetical fiction of some kind. A course of slow historical development was traced back to a single great deed, a single personal cause. Almost no one scrupled to give to existing conditions the sanction of venerable age by means of fabricated history or forged documents. The question whether the ascribed derivation was true interested no one; it was enough if the result harmonized with existing rights, dominating interests and prevalent beliefs.»

2. Mediæval Annals and Chronicles.— An excellent illustration of the primitive nature of mediæval culture is the fact that during the first centuries the main form of historical writings was the 'Annals' which had been common in early Egypt and Babylonia. The mediæval example of this type of historical writing originated in the early Carolingian period as an incident of the mediæval desire to locate the exact occurrence of Easter. The absence of a general knowledge of astronomy and chronology made it necessary for the more learned churchmen to prepare and distribute to monks and priests Easter tables giving the dates upon which Easter would occur for many years in advance. An almost universal practice arose of indicating on the margin opposite each year, the event, which, in the mind of the recorder, seemed to make that year most significant in the history of the locality. Not only were these early annals very scanty in the information they contained, on account of mentioning only one or two conspicuous events which occurred during the year, but they were rendered still less valuable because the mediæval annalist frequently considered most important some insignificant avowed miracle or the transfer of the bones of a saint, information of little or no value to the modern investigator. In time, however, entries were more frequent and the interests of the annalist grew wider, until the annals became, with such a work as Roger of Hoveden's 'Annals of English History,' in the early 13th century, a valuable record of the development of a nation.

The origin and development of the 'Chronicle' was immediately related to the growth of the annals. The annals were primarily a yearly record set down by a contemporary. The chronicle was more comprehensive. It normally consisted in the summarizing of the history of a considerable period on the basis of one or more sets of annals, preserving the chronological arrangement of the annals. Many of the events transcribed by the chronicler might have occurred before his period and he might combine the records contained in several annals in order to obtain a more complete and comprehensive story. To this compilation of annals was usually added, as an introduction, Jerome's translation of Eusebius' 'Chronicle,' which linked up the local chronicle with the Christian synthesis of world history from the beginning of creation. With the expansion of the basic annals in scope and pertinence, the chronicles became more and more an approximation to a history, until in the 'Anglo Saxon Chronicle,' the 'Chronicle' of Hermann of Reichenau (d. 1054), the 'Universal Chronicle' of Ekkehard of Aurach in the early 12th century, the 'Chronicle' of Otto of Freising (d. 1158) and the 'Greater Chronicle' of Matthew of Paris (d. 1259) this characteristic vehicle of mediæval historiography became one of the most thorough and reliable sources of information available in that age.

The following were the most important of the mediæval annals. For the Carolingian period the 'Greater Annals of Lorsch' and their continuation to 829 in the 'Royal Annals,' the 'Annals of Fulda' and the excellent 'Annals of Saint Bertin' and 'Saint Vaast,' coming down to the beginning of the 10th century, are the most valuable. The most important annals dealing with early French history are those of Flodoard (d. 966). For English mediæval history there is the above mentioned work of Roger of Hoveden coming down to 1201. For mediæval Germany the great annalistic sources are the elegantly written but prejudiced 'Annals of Lambert of Hersfeld,' covering the period to 1077, and the more valuable 'Greater Annals of Cologne,' which come to 1237.

The chronicles dealing with mediæval German history begin with those of Fredegarius the Schoolmaster in the 7th century and of Regino of Prüm in the 10th, and include the authoritative 'Chronicle' of Hermann of Reichenau (d. 1054), Ekkehard of Aurach's 'Universal Chronicle,' compiled at the beginning of the 12th century and the most comprehensive of all mediæval chronicles, the 'Chronicle' of Otto of Freising (d. 1158), the most notable of 12th century historians, and the valuable 'Chronicle' of Arnold of Lübeck (d. 1212). For France the more famous chronicles are the 'Chronicle of Nantes,' coming to 1049, those of Hugh of Flavigny and Sigebert of Gembloux in the 12th century and of William of Nangis at the beginning of the 14th century. The 'Chronicles' of Froissart (1373 ff) are attractive but highly colored and prejudiced and they illustrate to some extent the transition from the mediæval chronicle to the historical narrative. For England the great mediæval chronicles are the 'Anglo-Saxon Chronicle,' describing events to 1154; Roger of Wendover's 'Flowers of History,' coming down to 1235, and their continuation to 1259 in Matthew of Paris' 'Greater Chronicle.' From Italy is the valuable and voluminous 'Florentine Chronicle' of Giovanni Villani, dealing with events to 1348.

3. Attempts at Systematic History.— The efforts to produce something like a systematic historical treatise during the mediæval period varied greatly in their success. Their nature was, on the whole, closely correlated with the changes in the general level of culture. The earliest were usually slovenly and labored in style, sadly inaccurate in grammar and entirely credulous and uncritical in method. In the latter part of the period, however, the level of scholarship was raised, and in the works of such an historian as Otto of Freising, in the middle of the 12th century, one meets for the first time with an author who will compare favorably with the second-rate figures in classical historiography. On the whole, there were few attempts at a general or international history of a period, and the histories chiefly concerned local or national events and movements or the deeds of a conspicuous national monarch.

The following were the more important works dealing with German history from the period of the «Invasions.» The first of these, and the earliest product of mediæval historiography, was the 'Ten Books of Frankish History' of Gregory of Tours (540–594), which is the main source of information regarding the origin of the Merovingian dynasty. It was naïve, credulous and prejudiced against the Goths, but was an exceedingly straightforward and human document, and was based, to a considerable degree, on Gregory's direct observations. The Lombards found their national historian in Paul the Deacon (725–800), an erudite member of the group of scholars at the court of Charlemagne. His 'History of the Lombards' was greatly superior to Gregory's work with respect to both accuracy and style. The first layman to produce an historical work in the mediæval period was Nithard, whose 'Four Books of History' present an able and lucid narrative of the civil wars among the grandsons of Charlemagne and offer one of the few examples of vivid secular interests on the part of a mediæval historian. The Saxon emperors had as their dynastic historian the monk Widukind, whose 'Deeds of the Saxons' gave an able survey of the reigns of Henry I and Otto the Great. A more penetrating account of the culture of this period is found in the 'Book of Retribution,' the 'History of Otto' and the 'Legatio' of Liutprandt of Cremona (d. 973). The finest products of mediæval German historiography from the standpoint of style, accuracy and philosophic grasp were the 'Deeds of the Emperor Frederick the First' and the above mentioned 'Chronicle' of Bishop Otto of Freising (c. 1114–58). While his lack of any scientific canons of criticism, his revival of the Augustine-Orosius philosophy of history in his 'Chronicle' and his bias in favor of his royal patron all combined to prevent his ranking with the greatest historians of classical antiquity, his work illustrates the highest point to which the strictly mediæval German historiography attained. The eminent authority, Wegele, says of the work of Otto: «A writer possessing such extraordinary literary talent as Otto of Freising did not appear again in German history for many a century. However much Lambert of Hersfeld may have excelled him as a polished narrator, Otto more than made up for this by the deep seriousness of his world-philosophy and the loftiness of the view-point which he invariably maintained. Whatever anyone may think of his philosophy, he is the only mediæval German historian who was able to grasp in a philosophical manner the march of world-history and who sought to give it a judicious exposition. And he occupies no less conspicuous a position as a narrator of the history of his own times.»

For France, alleged historical works began with the prolix and highly prejudiced 'Four Books of History' of Richer, who wrote at the very close of the 10th century and is almost the sole source for the establishment of the Capetian dynasty. An even less reliable and a thoroughly mediæval work with the same title by Raoul Glaber carried the story down for a half century further. Somewhat better was the 'Gesta Dei per Francos' of Guibert of Nogent (1053–1124), which tells the story of the First Crusade, but it is based largely on an earlier Norman narrative and the author is hopelessly confused when he loses his guide. In the 12th century a superior work appeared in the lively and attractive 'Ecclesiastical History' of Ordericus Vitalis (1075–1142). Something like a real history is to be seen in Rigord's (c. 1150–1209) 'Deeds of Philip Augustus,' in the preparation of which the author made some elementary use of the available documents, letters and archives. The 'Conquête de Constantinople,' by Geoffroy de Villehardouin (c. 1160–1213), was one of the more notable historical products of the Middle Ages. It was the first mediæval historical work of any consequence which was written in the vernacular. While it was somewhat of an apology for Villehardouin's policy in the Fourth Crusade, it is much the best extant source for an interpretation of the real spirit of the Crusaders. It was a straightforward account, written in a vigorous and concise style being full of personal touches and throbbing with virile human interests. The 'Chronicles of France, England, Scotland and Spain,' originally written by Froissart (1338–1410), a 14th century Lamartine, about 1375, have been mentioned above. They were the work of a poet and chronicler and were avowedly written to «delight and please» his readers, and in this he succeeded wholly. It is episodical history at its best for literature and near its worst for history, though it is the fullest extant source for the Hundred Years' War. An incomparably superior historical work was the 'Mémoires' of Philippe de Commines (c. 1445–1511), dealing with the period of Louis XI. It was a vigorous narrative exhibiting almost all of the traits of the true historian — a good grasp on the meaning of events, penetrating analysis of motives, a description of contemporary culture and sound generalizations. Especially did Commines emphasize the political and pragmatic value of history and advised all statesmen and diplomats to «study it well, for it holds the master key to all types of frauds, deceits and perjuries.»

With this work French history enters on the modern period.

Aside from the above mentioned chroniclers, the avowed mediæval English historians were few. The confused and gloomy description of the invasions by Gildas (c. 516-570) has acquired an undeserved fame because of its being the only available source for that important period. A fine product of the lingering classical culture in the north of Europe is to be found in Bede's (c. 672-735) famous 'Ecclesiastical History of the English Nation.' The work of a real literary artist and scholar, it was a reminiscence of a fast passing culture rather than a promise of a new era in historiography. On the Anglo-Saxon and Norman monarchs a work of interest and merit was 'The History of the Kings of England,' by William of Malmesbury (d. 1142). It is generally agreed that the leading English mediæval historian was Matthew of Paris (d. 1259) His 'Greater Chronicle' dealt with the troubled times in the middle of the 13th century just preceding the beginnings of the English parliamentary system. The cautious English historian and critic, James Gairdner, thus summarizes the characteristics of Matthew of Paris and his historical writings: "His narrative is plain, straightforward and lucid, with here and there a little bit of graphic description, but it contains nothing that is highly coloured or introduced as a mere embellishment. The whole interest of the history arises simply out of the facts themselves and the truthfulness with which they are depicted. The writer was far too much interested in what he had to tell to adorn it with meretricious graces. He was a politician who felt the moral significance of all that took place in his day, whether in England, at Rome, or in the distant East; and he expresses his judgment without the least reserve, alike on the acts of his own sovereign, of his countrymen, and of the court of Rome. He is, in fact, the most distinctly political historian with whom we have yet had to do. He has, no doubt, his feelings as a monk, resenting the presumption, in some cases, of these new orders of friars, though even here his complaints seem very fair. But his thoughts rise altogether above mere class and party considerations. He is not so much a monk as an English politician, and yet not English exclusively, but cosmopolitan. His merits, even in his own day, as a man of great judgment and impartiality seem to have been renowned over Europe."

4. Mediæval Historical Biography.— The personal prowess of the great political and military figures in the Middle Ages made attractive subjects for historical biography. Often the monarch subsidized or otherwise favored a biographer to ensure a properly flattering record of his deeds. Needless to say, strict impartiality was never observed, and sycophancy often was added to the other defects of mediæval historiography. In addition, the theological coloring of all mediæval thought led the biographer to represent the great secular figures of the period as the chosen agents of Divine Providence in their age. Of these mediæval biographies the most notable were 'The Life of Charlemagne,' by Einhard; 'The Life of Louis the Fat,' by Suger; and Joinville's 'Life of Saint Louis,' one of the polished French historical works written in the vernacular. Here also belong, almost as much as in the field of systematic history, the works of Otto of Freising and Rigord. Among these mediæval biographers, especially such as Einhard and Joinville, one finds some of the best examples of the rare emergence of secular interests in mediæval historiography.

Several facts stand out from even the foregoing brief survey of mediæval historiography. In the first place, like the most of classical historiography, the historical works of the Middle Ages were for the most part concerned with strictly contemporary history. The treatment of a remote period was almost invariably in the nature of a rude and scanty chronicle of events. In the second place, it is almost impossible to differentiate sharply between chronicles, systematic histories and biographies on account of a common methodology. Thirdly, it is noticeable that the vast majority of the writers were churchmen. Therefore, while the ecclesiastics cannot be too severely criticized for their vitiation of historical methods, it is well to remember that without them mediæval historical literature would have been practically a blank. Fourthly, it will readily be apparent that mediæval history was almost exclusively episodical, there being almost no attempt to analyze the deeper social, economic and intellectual forces in historical development. Finally, one can easily discern that, with the stimulation of intellectual interests during and following the Crusades, there came an increase in the volume of historical output and an improvement in its quality that was a prophecy of a future recovery of the lost historical standards of classical antiquity.

5. The Arabic Historians of the Middle Ages.— The contribution of the Arabs to mediæval culture was not insignificant in the field of historiography, but only a few of the more notable Arabic historians can be mentioned in this place. Orosius found his Arabian counterpart in Tabari (846-932), who compiled the first universal history from the Mohammedan point of view. The events of history were adapted to the creation of a "Mohammedan Epic" justifying the triumph of Islam. History and ethnography were combined in the voluminous works of Mas'udi (d. 966), whose wide travels carried him over most of Asia, Africa and Europe. Not until the publication of the histories dealing with the discoveries of the 16th century was there another work which contained as much descriptive ethnographic material. The ablest contributor to historical biography among the Arabs was Ibn Khallikan (d. 1282), whom experts rank with the best biographers of classical antiquity. The first Arab historian to possess any considerable philosophic grasp upon cause and effect in historical development was Athir (1160-1232). But far and away the ablest and most significant figure in Arab historiography was Ibn Khaldun (1332-1406). His importance lies in the unique feat, for the time, of having been able to rationalize the subject of history and to reflect upon its methods and purpose. At the outset, in his 'Prolegomena to Universal History,' which was the systematic presentation of his theoretical views, he drew a sharp distinction between the conventional annalistic and episodical historical writing of his time and history as he conceived of it, as the science of the origin and development of civilization. Anticipating Vico and Turgot, he comprehended the nature of the unity and continuity of historical development. In marked contrast with the static or eschatological conceptions of contemporary Christian historiography was his dynamic thesis that the process of historic growth is subject to constant change comparable to the life of the individual organism, and he made clear the coöperation of psychic and environmental factors in this evolution of civilization. Flint makes the following estimate of the significance of his work: "The first writer to treat history as the proper object of a special science was Mohammed Ibn Khaldun. Whether on this account he is to be regarded or not as the founder of the science of history is a question as to which there may well be difference of opinion; but no candid reader of his 'Prolegomena' can fail to admit that his claim to the honor is more valid than that of any other author previous to Vico."

VIII. Humanism and Historiography.

1. The Renaissance and Humanism.— Recent research and a more critical examination of the intellectual currents of European history have profoundly modified the exaggerated opinions of Burckhardt and Symonds with regard to the relation of the so-called "Renaissance" to the development of European thought. It has been shown that, at the best, this period did not mark a direct and conscious advance toward modern concepts, but was distinctly the revival of interest in an antique culture, which was in many fundamental ways opposed to the present-day outlook. This revival indirectly contributed toward the development of modern thought chiefly through its aid in breaking up the ecclesiastical "fixation" of mediæval thought and by bringing to the front again an interest in secular matters. In its broadest sense the literary phase of this movement is now conventionally designated as "Humanism," meaning by this not only a revival of interest in classical literature, but also a renewal of appreciation for the broadly human interests and outlook of pagan culture. It was primarily an emotional and intellectual reaction against the narrow and ascetic attitude of the theologians without constituting any real or conscious revolution in theology.

2. Characteristics of the Historiography of Humanism.— Though there were great differences in the quality of the product of the historians of this period, as, for instance, between the works of a Poggio and a Guicciardini, certain fundamental characteristics of the historiography of humanism were sufficiently general and universal to justify enumeration. The reaction of humanism upon historical writing was strictly in accordance with the fundamental aspects of the movement. It meant, in the first place, a search for classical texts and the comparison, criticism and improvement of those recovered. Again, it greatly reduced the element of the miraculous in historical interpretation and lessened the "emotional thrill" of the "Christian Epic." Pagan history was to some extent restored to the position from which it had been excluded by the Christian writers in general, and by Augustine and Orosius in particular. This was due in part to the admiration of the humanists for classical culture, and in part to the fact, that, for the first time since the passing of Rome, a majority of the leading historians were laymen and practical men of affairs rather than churchmen and theologians. Naturally, also, the classical models of historiography were effective in leading to an improvement in style and, what was more important, to a greater attention to political and social events and forces — it meant the re-secularization of history. A powerful impulse in this latter direction came from the beginnings of modern nationalism in the Italian city-states. Also, the criticism of literary texts produced at least an elementary sense of the value of a critical handling of historical documents. Finally, with the humanists history became more historical. With their centre of interest in the culture of a period long past, historical writing could no longer be limited entirely to contemporary history or to a mere repetition of the threadbare 'Chronicle' of Jerome. In the large, however, humanism meant to historical writing a great literary and cultural improvement but much less of an advance in scientific method — it was a great impulse to history as literature but in no such degree to history as a critical science. The canons of Isocrates, Livy and Tacitus rather than of Thucydides and Polybius, were the guide of humanist historians. Nor did humanism bring to historical writing that freedom from subserviency to vested interests and authority that is commonly supposed. It emancipated it to a large degree from the theological bias, but substituted a secular restraint which was often as damaging to objectivity and accuracy. As Professor Burr has well stated the case, "When the Middle Ages waned, the revived study of the ancients and the rise of a lay republic of letters did not at first, one must confess, greatly advance the freedom of history. The courtier humanist charged with a biography of his princely patron or a history of his dynasty, the humanist chancellor comsioned by the city fathers to write the history of the town, was perhaps less free to find or tell the truth than had been the churchly chronicler unhampered by hereditary lords or local vanity. The audience, too, was humanist, and the tyranny of rhetoric, never wholly dispelled throughout the Middle Ages, now reasserted itself with double power. It was the humanist historian's very function to make the glories of his prince or of his city a vehicle for the display of the Latin style to which he owed his post. And if history, thus again an art, a branch of literature, dared in a field so secular to shun the mention of ecclesiastical miracle and even to forget the great plan of salvation, it was too often to borrow from the ancients a strange varnish of omen and of prodigy." While it bore no causal relation to humanism, it should be remembered that it was during this period that the printing press was invented and introduced into general use. It gave a great stimulus to the "making of books" in the field of history, as in other branches of literary effort. In its largest significance for the future of historical science, the invention of printing can be compared only to the original mastery of the art of writing. It is not too much to say that neither Thucydides, Polybius, Blondus, Mabillon nor Ranke was as consequential or indispensable in making possible the present status of historiography as the inventor of the art of printing by movable type, be he Coster, Gutenberg or someone yet to be discovered.

3. The Chief Contributors to the Historiography of Humanism.— Aside from the scholars whose activity lay solely in the search for classical texts, the first important product of humanist historiography was 'The Twelve Books of Florentine History' by Leonardo Bruni (1369–1444). In this and his later 'Commentaries' are to be found nearly all of the characteristics of the historiography of the humanist school — a moderate adherence to the canons of style of the Greek and Roman Rhetoricians, the opinion that classical rather than contemporary culture was the most promising field for historical inspiration, the elimination of pagan and Christian miracles and legends, and a primary attention to the practical analysis of political events and activities. The standards of Bruni were adopted by his Venetian disciple, Marcantonio Coccio (1436–1506), known as 'Sabellicus,' in the production of the only serious humanist attempt at a world history, his 'Enneades.' Though he took his chronology from Eusebius, he restored to the history of antiquity some degree of proportion in dealing with the various nations by departing from the almost exclusive concern with Hebrew history, which had been the fashion for a millennium. Again, while he in no way foreshadowed Voltaire, that he made some progress toward rationalism and criticism may be seen from his placing the legend of Samson on a parity with that of Hercules. The great gulf between the historiography of the Patristic period and that of humanism can best be appreciated by a comparison of the 'Enneades' with 'The Seven Books of History against the Pagans.' If Bruni was the Herodotus of humanist historiography and Sabellicus its Diodorus, Poggio (1380–1459) was its Ephorus. His 'Eight Books of Florentine History' illustrate in its extreme form the influence of classical rhetoric on humanist historical literature and one may agree with Fueter that "what he gained as a literary artist he lost as an historian."

Of a widely different character from the work of Poggio was that of the most distinguished historical critic of the period, Laurentius Valla (1407–57). Valla's only systematic historical work, 'The History of Ferdinand I of Aragon' was not conspicuously successful. It proved the author to be a "scandal-monger" rather than a historian in the field of narrative, though it may have been a slight methodological advance to have substituted scandals for miracles. His achievement, for which he has received undue fame in the field of criticism, was the final proof of the forgery of the 'Donation of Constantine,' the authenticity of which had already been doubted by Cusanus and Bishop Peacock. As Fueter has clearly shown, Valla acquired fame by virtue of the venerable nature of the document he attacked rather than by the skill or erudition he displayed in its analysis. It was a testimonial to his courage rather than to his critical powers, which could be matched by several other humanists. As Emerton has said, "The most interesting thing about the exposure is the amazing ease of it. It does not prove the great learning or cleverness of the author, for neither of these was needed. The moment that the bare facts were held up to the world of scholars the whole tissue of absurdities fell to pieces of its own weight." More skill was shown in his 'Duo Tarquinii,' an attack on Livy's treatment of a certain phase of early Roman history. This work also showed that the most highly esteemed of secular authorities was no more immune from critical examination than venerable ecclesiastical documents. Valla's methods were applied by his Venetian contemporary, Bernardo Giustiniani (1408–89), to dissipate the legends connected with the founding of Venice.

Far the greatest historical scholar that Italian humanism produced was Flavius Blondus (1388–1463), the Timaeus of humanism, who devoted his life to a study of the antiquities of ancient Rome and the rise of the mediæval states. His chief work was 'History since the Decline of the Power of the Romans,' in 31 books. The most notable thing about this work, aside from the careful scholarship, was the original attitude that its author displayed in his interpretation of the significance of the mediæval period. "The novel element in the attitude of Blondus," says Professor Burr, "is that instead of thinking of the Middle Ages as the continuous history of a Roman Empire, as mediævals had been wont to do, he left Rome to the past and told the story of the rising peoples who supplanted her." "He contributed more," says Fueter, "to our knowledge of the Middle Ages and of Roman antiquity than all the other humanists combined." It is the best possible illustration of the canons of humanism that its greatest historical scholar and *savant* was never given formal recognition or reward for his great contribution to scholarship, because he did not possess an elegant literary style. In a more fundamental sense, perhaps, his work was given the greatest testimonial possible, in that, of all products of the historical scholarship of the period, it was the most plagiarized for information by later writers. In this way it contributed indirectly to the improvement of historical scholarship. The unpopularity of scholarship for its own sake, as shown by the experience of Blondus, explains why he had but one true Italian disciple, Calchi (1462–c.1516), the historian of Milan. Blondus was the true precursor of Mabillon and Tillemont.

The humanist Pope, Æneas Sylvius Piccolomini (1405–64), deserves mention in a sketch of humanist historiography more from the nature of his personal career and the influence he exerted on later German writers than from the value of his contributions to systematic history or to the improvement of historical method. His numerous historical works, 'Commentaries on the Council of Basel'; 'The History of Frederick III'; 'The History of Bohemia'; 'The History of Europe'; 'Universal History,' and 'Commentaries,' or his autobiography, were superficial, without deep philosophical grasp, fragmentary and incomplete. Contrary to the usual view, he did not even equal Bruni as an historical critic, to say nothing of Valla and Blondus. On the other hand, he was a man of action in politics to a degree scarcely equalled by Polybius or Tacitus. No contemporary knew more of

European politics and culture than he, and the most valuable aspect of his historical works is the fact that they are full of personal memoirs. As a member of the imperial chancery of Frederick III and through his later ecclesiastical relations with the empire, his interest in German history and culture was greater than that of any of his Italian contemporaries. His significance in the development of historiography rests primarily upon his works on German history and his influence on later German historians. In his history of Frederick III he made large use of Otto of Freising and brought him to the attention of contemporaries. His history of Bohemia was probably the first attempt of a humanist historian to introduce ethnography into historical literature. Finally, his history of Europe and his universal history sought to bring out the interrelation between history and geography. It was in these respects, chiefly, that he influenced later German historians. Fueter says on this point: «Æneas Sylvius was mainly responsible for the later appearance in the works of many German humanist historians of the tendency to introduce into works on history excursions into the origin and growth of law and the relations of geography to historical development, to assume at least a semi-critical attitude toward the legends of racial origins, and to display a boisterous chauvinism in matters touching the question of nationality.»

Historical biography among the humanists was founded bv Filippo Villani (c.1325–1405) in his survey of the most illustrious citizens of Florence. Always handicapped by the crudeness of their classical model, Suetonius, the biographical products of the period were not as successful as the more systematic historical works. The only notable work was Giorgio Vasari's (1511–1574) 'Lives of the Most Eminent Painters, Sculptors and Architects.' This lacks almost every characteristic of a good historical work, but has become famous because of its subject matter and the scarcity of other sources. It was the first real history of art.

The transition from strictly humanist historiography to the beginnings of modern political and national historical writing in Italy was well illustrated by the works of the Florentine historians, Machiavelli and Guicciardini. The cultural supremacy of Florence at the time, and the intensity of its political life, combined to make it a particularly favorable environment to stimulate the production of works of high value. With Blondus they valued truth more than rhetoric, but they were saved from the former's obscurity and unpopularity by avoiding a labored and pedantic style. With them history became wholly secular and was limited primarily to a straight-forward narrative and analysis of political events. Some attempt also was made to substitute a psychological and material theory of causation for supernaturalism.

Machiavelli (1469–1527) was primarily a political philosopher without any particular emotion for history unless it was utilized in the interests of political theory. It is this tendency which gives his major historical work, 'The History of Florence,' its distinctive characteristics. From the standpoint of style or accuracy it was not superior to some other histories of the period, but is it doubtful if any previous historian since Polybius, with whom Machiavelli was thoroughly familiar, had exhibited the power of grasping the nature of historical causation or of presenting a clear picture of the process of historical development that Machiavelli displayed in his analysis of the political evolution of the city of Florence. It was as a political thinker and organizer of causal factors that Machiavelli excelled, and not as an objective narrator of political events.

Not at all philosophical, but more truly historical, was Guicciardini (1483–1540). His 'History of Florence' is one of the truly original works in historiography in that the author broke almost completely with both Patristic and humanist historiography and even went beyond the classical historical conventions in one particular, namely, that he eliminated the introduction of direct discourse in his narrative. In his lucid style, free from digressions and irrelevant details, there was no trace of florid rhetoric, and his primary concern with contemporary political history allowed him, in the latter part of the work, to dispense, to some extent, with the annalistic and strictly chronological arrangement of the conventional historical writing of his time. He made no attempt at philosophic analysis, but devoted himself solely to a vigorous and incisive narrative of events and a candid criticism of men and policies. «With the 'Florentine History,'» says Fueter, «there began modern analytical historiography and political ratiocination in history.» Most critics contend that with Guicciardini's 'History of Florence' historiography in western Europe had again attained to the level of Thucydides and Polybius. It had, however, no influence on contemporary historiography as it was not published until 1859. From the standpoint of style and arrangement Guicciardini's other major work, 'The History of Italy,' was less original because here he compromised with those rhetorical conventions of humanism which he had so rigorously excluded from his first work. But with respect to its breadth, scope and original mode of approach, the latter work was even more epoch making. For the first time a historian had been able to break with tradition and free himself from primary concern with any particular state or dynasty and to devote his attention to a much broader field — «the history of a geographical unity.» This gave him an unprecedented opportunity to study the growth and decline of states, the interaction between states in all the phases of international relations, and the processes of political evolution. In other words, the subject-matter offered rare opportunities for the study of universal history reproduced on a small scale, and, though Guicciardini almost entirely lacked that philosophical insight into social and political processes that distinguished Machiavelli and was thereby prevented from making the first great study of social and political evolution, the very novelty of his program constituted a great advance in historical method. Few will deny that Guicciardini reached the highest level to which post-classical historiography attained until the time of Mabillon, but the great progress that was necessary before modern scientific political history could be reached is best appreciated by a perusal of the rather over severe criticism of Guicciardini by Ranke, the earliest, but by no means the most cautious and scholarly of the modern school. The modern standards might more quickly have been reached had not the Reformation set back the progress of historical writing by the resurrection of theological interests and religious bias and controversy which humanism was gradually and peacefully smothering. Not until the theological monopoly had been crushed by the rationalism of the 18th century and secular interests had been reinforced by the commercial revolution and the rise of modern nations could any fundamental advance be achieved.

Outside of Italy, humanism found many distinguished converts, and not the least of them in the field of history. In general, the conventional canons of humanist historiography were faithfully followed, though there were some variations introduced as a result of changing conditions. As the movement was somewhat belated beyond the Alps, it became complicated by the religious conflicts of the Reformation period and took on a concern with ecclesiastical matters which was quite foreign to the Italians of the 15th century. Again, the literary tastes remained less purely classical; and, in the zeal for florid rhetoric and sharp invective, Tacitus, rather than Livy, became the model of many of the northern humanists in the 16th century. As in Italy, so in the north humanist historical literature gradually evolved into the beginnings of modern political historiography.

The most scholarly product of the historiography of Swiss humanism was the history of Saint-Gall by Joachim von Watt, better known as Vadianus (1484–1551). He is generally rated as a historian superior to Blondus. He not only rivalled Blondus in textual criticism, but also advanced a step further toward Ranke by making some rudimentary progress toward the internal criticism of the tendencies of the authors of the documents. He was able, further, to combine erudition with a clear and vigorous style and good grasp upon the general factors of historical development. Fueter regards his work as the most broadly conceived product of the historiography of humanism on account of the wide scope of the subjects and interests embraced. It was, however, doomed to an even longer period of obscurity than awaited Guicciardini's 'History of Florence,' because it was not published until the third quarter of the 19th century.

In Germany the list of distinguished humanist historians begins with the name of Albert Krantz (1450–1517), who, following Aeneas Sylvius, was one of the first to apply the literary and historical methods of humanism to a study of primitive peoples, in his histories of the early Saxons and Wends. More famous was Johannes Turmair, known as Aventinus (1477–1534). In his 'History of Bavaria' and his 'History of Early Germany' he tried to combine the literary canons of Bruni with the scholarship of Blondus, but fell far short of either, and his bitter Protestant bias prevented any objective treatment of contemporary affairs. Few writers of the period, however, equalled him in his ability to analyze and interpret the manners and customs of a people. Ulrich von Hutten (1488–1523) was more distinguished for his brilliant satire in his campaign against bigotry than for his contributions to historical literature, but his recovery and publication, with extended comments, of a manifesto of Henry IV against Gregory VII was both a shaft of Protestantism against Rome and a valuable addition to historical knowledge. The only distinguished representative of the erudite and critical tendencies of Blondus among the German humanist historians was Beatus Rhenanus (1486–1547), the friend and disciple of Erasmus. He examined the sources of early German history with the same exact and objective scholarship that Erasmus had applied to the ecclesiastical records and doctrines. While he lacked the ability to organize his work into a coherent exposition of its results, his labors represent the highest level of scholarship to which the historiography of German humanism attained. Of all the publicists who have a place in the historiography of German humanism, Samuel Pufendorf (1632–94) was the leader as a historian. His works included a 'History of Sweden,' a 'History of Frederick William the Great Elector' and 'An Introduction to the History of the Leading Powers and States of Europe.' He had a fine classical style, but exhibited to its fullest extent that fundamental fault still common to publicists when they enter the field of historical literature, namely, a concern only with the few distinguished figures in international relations and with that hitherto most superficial field of political history, the record of international relations when unaccompanied by any attention to internal political or social history. As in the later work of Droysen, one searches in vain in the mass of references to external politics for even the slightest appreciation of those deeper popular movements and forces of which diplomatic history can give only the most scanty and unreliable reflection and information.

A more distinguished scholar and publicist than Pufendorf, but not so noted an historian, was the Dutch writer, Hugo Grotius (1583–1645), the founder of modern international law. His chief historical work was 'The History of the Netherlands.' Though his style, in imitation of Tacitus, was pompous, prolix and involved, he displayed great ability in psychological analysis and in dissecting the problems of military and political history connected with the struggle between Spain and the Netherlands.

That humanist historiography in England was closely related to the origins of that intellectual movement in Italy is to be seen in the fact that the first product of this type of histoical literature in England was the scholarly and well-written 'History of England in the Reign of Henry VII' by Polydore Vergil (1470–1535), an Italian ecclesiastic who had made his home in England. His scholarship was not matched in the British Isles until the time of Camden, a century later. England's earliest native humanist historian of note was Sir Thomas More (1478–1535), whose polished style found expression in his 'History of Richard III.' Of all the British historians of this period, it is probable that the truest representative of humanism was the erudite Scot, George Buchanan (1506–82). Few of the best Italians equalled him for the purity of his Latin diction and the vigor and clarity of his narrative, but his 'History of Scotland' was most uncritical and credulous, utterly lacking in rationalistic tendencies and marred by a narrow chauvinism. Machiavelli and Guicciardini found their English disciple in the philosopher and statesman, Francis Bacon (1561–1626). His 'History of the Reign of King Henry the Seventh' was especially notable for bold criticism, «judicial severity,» and the frank expression of the author's opinions. The English representative of the erudite and critical school of Blondus was the court historian, William Camden (1551–1623), an avowed admirer of Polybius. In his 'Annals of English and Irish History in the Reign of Elizabeth' he showed, like his French contemporary De Thou, that the political history of the 16th century could not be wholly divorced from ecclesiastical questions.

The transition from humanism to modern political history in England was illustrated by the works of Lord Clarendon (1609–74) and Bishop Burnet (1643–1715). While the general arrangement of Clarendon's 'History of the Rebellion and Civil Wars in England' resembled the French «memoirs,» and though it was most superficial in its analysis of the fundamental social and political causes of the civil wars; it is doubtful if any previous historian, classical or humanist, possessed Clarendon's power of vivid delineation of personalities. Bishop Burnet, in his 'History of the Reformation of the Church of England' and 'History of My Own Time,' was the first historian of party intrigues and parliamentary debates, a subject scarcely available for any previous writer. An ardent Whig and Anglican, he belonged more to the forerunners of modern political history than to the list of disciples of humanism.

Spain contributed three important figures to humanist historical literature in Diego Hurtado de Mendoza (1503–75), Juan de Mariana (1535–1625) and Gerónimo de Zurita (1512–80). While Mendoza wrote his 'History of the War with Granada' in a pompous, archaic and involved style, he equalled Bacon or Guicciardini in his sharp criticisms and acute judgments. Mariana, a Spanish Jesuit, was a writer of quite a different sort. He has been called the Spanish Buchanan by Fueter, and his 'History of Spain' in 30 books resembled the work of the Scot in its excellent style and cautious criticisms of Christian legends. His liberal allotment of space to ecclesiastical matters was a breach with humanist conventions. Much less able in narration, but a far more critical scholar, was Gerónimo de Zurita, the historian of the kingdom of Aragon and the most prominent and faithful disciple of Blondus among the Spanish historians of this period. He was especially significant through the fact that he was one of the first historians to make an extensive and fairly critical use of the diplomatic correspondence in reconstructing the record of political events in the distant past.

The most notable product of the historical scholarship of the French humanists was the work of Joseph Justus Scaliger (1540–1609) in the field of historical chronology. His 'De emendatione temporum' was a bold attempt to put chronology on a scientific basis by revising the «sacred» chronology in the light of the evidence from the history of the «gentile» and «pagan» nations of antiquity. His 'Thesaurus temporum' was a most notable performance of scholarship, which provided a general history of the development of chronology and included a most valuable reconstruction of the lost 'Chronicle' of Eusebius. Scaliger's publicist contemporary, Jean Bodin (1530–96), in his 'Methodus ad facilem historiarum cognitionem,' produced the first extensive treatise on historical method, with the emphasis on interpretation rather than upon criticism of sources. Especially significant was the emphasis which Bodin placed upon the influence of geographical factors in historical development, thus opening the way for Montesquieu and Ritter. It was, therefore, to a much greater degree a forerunner of the first chapter of Buckle's 'History of England' than of Bernheim's 'Lehrbuch.' A widely different contribution to historiography was contained in the work of Jacques Auguste de Thou (1553–1617), conventionally known as Thuanus. He was probably the most notable French contributor to the systematic historiography of humanism. His 'Historia sui temporis,' designed as a continuation of a work of the same title by the Italian humanist, Paulus Jovus (1483–1552), described the civil and religious wars in France in the latter part of the 16th century according to the spirit of an enlightened and tolerant French Protestant. He introduced into historiography the laudable tendencies displayed by his royal master and friend, Henry IV, in statesmanship. As might be expected in the work of one of the jurists who aided in drafting the «Edict of Nantes,» he was scarcely fair to the extreme Catholic party, but his message was a lofty and noble plea for mutual religious toleration in the larger interests of France. His work exhibited great powers of extended intellectual labor and uniformly maintained a great dignity of tone. He might have equalled Machiavelli and Guicciardini if he had not reintroduced the theory of the divine determination of political causation, and if he had possessed the constructive literary ability which would have enabled him to organize his work into a coherent narrative. He may be said, however, to have improved upon them in one regard, namely, that he showed how essential a proper consideration of ecclesiastical affairs may be to a thorough understanding of political and constitutional development. The contributions of de Thou's contemporary, Isaac Casaubon, will be discussed in another connection. The finest literary product of the historiography of French humanism was the polished 'Mémoires' of Saint-Simon (1675–1755) dealing with France under the early Bourbons.

IX. THE PROTESTANT REFORMATION AND THE COUNTER-REFORMATION IN HISTORIOGRAPHY.

1. Its Effect upon the Subject-matter and the Interpretation of History.— In the same year that Machiavelli received his commission to write his 'History of Florence' Luther burned the papal bull at Wittenberg and the Protestant Reformation was soon in full swing. A rude shock was given to the great impulse of humanism toward the healthy secularization of historical literature, and the centre of historical interests was again forced back into the rut of theological controversies from which it had been trying to free itself since the days of Augustine and Orosius. Again to quote from Professor Burr, «To the freedom of history there came a sudden check with the great religious reaction we call the Reformation. Once more human affairs sank into insignificance. Less by far than that of the older church did the theology of Luther or Calvin accord reality of worth to human effort. Luther valued history, it is true, but only as a divine lesson; and Melanchton set himself to trace in it the hand of God, adjusting all its teachings to the need of Protestant dogma. Had either Papist or Lutheran brought unity to Christendom, history again must have become the handmaid of theology.» Not only were ecclesiastical matters, dealing with both dogma and organization, deemed the all essential sphere of historical investigation, but also universal history was again regarded as purely a great struggle between God and the Devil. Two new «Cities of Satan,» however, replaced the pagan «City» of Augustine and Orosius,— the 'Teufels Nest zu Rom,' and the followers of «the crazy Monk of Wittenberg,» respectively. The struggle was now limited to Christendom, which became «a house divided against itself.»

It is scarcely necessary to point out the fact that this revival of the religious orientation of historical interest was as fatal to the fine objectivity of Guicciardini's type of historical product as it was to the maintenance of the secular point of view of the Florentine school. There was no longer any thought of prosecuting historical studies for the mere love of acquiring information or of enriching the store of knowledge regarding the past, as Blondus had labored for these purposes alone. History again became as violently pragmatic as with Augustine and his disciples. The past was viewed merely as a vast and varied «arsenal» from which the controversialists could bring unlimited supplies of ammunition for the conflict and put their enemies to an inglorious rout. The embryonic canons of criticism which had been in part restored by the best of the humanist historians were lightly ignored, and each party consciously strove to produce the most biased account of past events possible, in order to exhibit their opponents in the most unfavorable light. Sources of information were not valued for their authenticity, but for their potential aid in polemic exercises, and invective replaced the calm historical narrative. Finally, it should be emphasized that since the period of the Reformation there has been little opportunity for a completely free and impartial study of the mediæval period. An epoch, the interpretation of which was so vital to the two great religious groups of Christendom, could scarcely again become a field for calm and dispassionate analysis.

It would be inaccurate, however, to hold that the Reformation gave no impulse to historical investigation. Never in the palmiest days of classical or humanist historical writing was there a more feverish energy exhibited in scanning the records of the past; the great defect was not in the nature of a decline in activity or interest, but in the character of the impulse that led to this vigorous quest for information and the manner of use to which the knowledge was put after it had been acquired. Protestant historians were «aided by the God of Saint Paul» in the search for evidence that would prove beyond a shadow of doubt that the elaborate ritual and body of dogma of the Roman Catholic Church had been wholly an extra-scriptural and semi-pagan growth, and that the Pope was the real Anti-Christ; and Catholic investigators were «specially guided by the Blessed Virgin» in their counter-demonstration that the Church and all its appurtenances were but the rich and perfect fulfillment of Scripture, and that the Protestants were inviting a most dreadful and certain punishment by their presumptuous and sinful defection from the organization founded by Saint Peter in direct obedience to the words of Christ. The only real contributions made by the controversy were the recovery and publication of important early documents on Church history and the production of telling criticisms by both factions which could be combined a century later by the rationalists to their mutual discomfiture.

2. The Chief Products of the Controversial Period.— The first serious contribution of the Protestant camp was 'The Lives of the Popes of Rome' by Robert Barnes (1495–1540), an Anglican Lutheran who had fled to Germany for protection. Composed under Luther's direct supervision, it endeavored to prove the popes responsible for all the disasters of the Middle Ages and praised the virtues of their secular opponents. At last, the methods of Orosius had been turned against the Church itself. Much more important were the voluminous 'Magdeburg Centuries,' a composite work planned and edited by Matthias Vlacich (1520–75), better known by his latinized name of Flacius. He was aided by a number of prominent Protestant scholars, such as Alemari, Copus, Wigand and Judex. The history of the Church and of Christian doctrine was reviewed by centuries down to 1300 in the effort to prove direct historicity in the Lutheran position and to show that the Catholic doctrines and organization had been an exotic and unholy growth away from the purity of Apostolic Christianity. While the authors displayed considerable critical ability in dissecting the papal doctrine and dogmas, they exhibited an equal gullibility in accepting preposterous tales to bolster up their side of the controversy. Its significance lies chiefly in the fact that it founded Church history in its modern phase. Another Protestant polemic appeared about this time in England and met with great popular success. This was 'The Acts and Monuments of the Christian Martyrs,' by the Englishman, John Foxe (1516–87). Beginning with Wycliffe, it traced the record of Protestant martyrs in such a manner as especially to represent the struggle as one between the purity and the perversion of Christianity — between Christ and the Anti-Christ. Protestantism found its Scottish champion in John Knox (1505–72), who wrote his 'History of the Reformation in Scotland' to prove the particular solicitude of the Devil for the welfare of the Catholic cause. In spite of its obvious bias, however, Knox's work was greatly superior to that of the Centurians and Foxe. From the standpoint of literary quality, his history was a work of genius, «displaying a marvelous precision and sureness in the selection and presentation of the significant and striking details.» Nor did he fail to condemn in the most vigorous terms those who adopted Calvinism as a means of gaining selfish material ends or resorted to violence in the name of religion in order to revenge political or personal grievances. A work which can scarcely be regarded as a part of the campaign of theological polemic that is being described, but which calls for some brief notice on account of its great interest and significance for the history of the Reformation, is the "Commentaries on the Political and Religious Conditions in the Reign of Emperor Charles V" by Johannes Philippi (1506–66), more generally known by his latinized name of Sleidanus. The great importance of his work is that it was the first political analysis of the Reformation movement and the Protestant revolt. He was the official constitutional apologist of the Lutheran states of northern Germany, and his task, not unlike that of Jefferson, was to justify at the bar of public opinion the entire legality of the secession of the Protestant princes from the Empire. He, therefore, approached the history of the movement from a political and constitutional rather than a theological point of view. While he limited himself wholly to authentic documents, his work was the product of an advocate; though not a polemic, it was a lawyer's brief carefully selecting and marshalling the evidence to be presented. As might be expected from such circumstances, his "Commentaries" exhibited great power in the organization and concentration of material, an admirable lucidity of expression and a dignified tone, designed to make an appeal to the learned public of Europe. While it contained none of Ranke's religious fervor and in no way anticipated the social studies of Janssen, his work was of the greatest significance as a direct foreshadowing of the now generally accepted thesis of Professor Robinson that the Protestant revolt was far more a political than a religious movement — that it looked more toward the political adjustments of the Peace of Augsburg and the Treaty of Westphalia than to the triumph of the theology of "justification by faith." He anticipated this interpretation, not only through the general mode of his approach to the problem, but also by specific comments upon the underlying political causes of the revolt.

The Catholic counter-blast was initiated by the monumental ‘Annales ecclesiastici’ of Cardinal Cæsar Baronius (1538–1607), the director of the Vatican library. By the use of an enormous mass of evidence he tried to prove the New Testament origin of Catholic Christianity and to show its logical development from Scriptural foundations. While he was more critical in his use of sources than the authors of the ‘Centuries’ and introduced more unpublished documents, the work was purely a polemic and marked no advance in historical method. In one way it was decidedly a retrogression. As the most authoritative critic of the historiography of this period has clearly shown, Baronius was mainly responsible for the introduction into historical controversy of the method of shuffling, quibbling and evasion, which has particularly characterized the Jesuit controversialists. He endeavored to avoid meeting dangerous issues by trying to confuse and obscure the vital question through turning the discussion into secondary and irrelevant channels. The crudities and errors in the work of Baronius were revealed in the searching criticism of the great humanist scholar, Isaac Casaubon (1559–1614), to whom Baronius' weaknesses due to his inability to handle Greek were readily apparent. He devoted the last years of his life to a refutation of Baronius in his ‘Exercitationes in Baronium.’ The ‘Annales’ were later continued with much greater scholarship by Odoricus Raynaldus (1595–1671), a learned Italian ecclesiastic. The second great Catholic champion was the French bishop, Jacques Bénigne Bossuet (1627–1704). In his ‘History of the Differences among the Protestant Churches’ he endeavored to convince the Protestants of the error of their ways by showing them that there could be no logical end to sectarian divisions once the crucial initial break had been made with ecclesiastical authority. Bossuet's importance lies in the fact that he alone of the controversialists, Protestant or Catholic, was able to get beneath personalities and events and to view the conflict in its deepest philosophical aspects as a struggle between liberty and authority, in which the victory of liberty meant to him indifference, atheism and religious anarchy. In his ‘Discourse on Universal History’ he appeared as the Orosius of the Counter-Reformation. Though incomparably more able and philosophic than the ‘Seven Books against the Pagans,’ it was less critical and less historical than the ‘Enneades’ of Sabellicus. "His ‘Discourse,’" says Fueter, "was not an historical work. It was merely a sermon in which the biblical text was supplanted by historical subject-matter carefully edited and prepared in the interest of the Church." It was the last serious attempt at an interpretation of universal history in terms of the old theology. After Voltaire had published his ‘Essai sur les Mœurs’ in the middle of the next century, no one dared to risk his reputation by a revival of the doctrines of Orosius and Bossuet.

The above-mentioned works of controversy are only the more notable ones selected from the great volume of lesser contributions to the historical literature of the Reformation and Counter-Reformation, but they sufficiently illustrate the general tendencies in method and interpretation. It has not entirely ceased at the present day as one can readily perceive by a comparison of the works of Ranke and Schaff with those of Döllinger and Janssen. While humanists and religious controversialists were writing, a new Europe was being shaped by the effects of the commercial revolution, out of which was to come modern civilization and with it the birth of scientific historiography.

X. THE CHIEF INFLUENCES IN THE SHAPING OF MODERN HISTORIOGRAPHY.

1. The Era of Discoveries and the "Commercial Revolution."— Inasmuch as history down to very recent times has been regarded as primarily the domain and province of the theologian or *littérateur*, it was but natural that either the Reformation or the Renaissance should be taken as marking the origin of the modern phase of the development of historiography. Now that it has come to be generally conceded that, in its broadest interpretation, history is a branch of social science and related generically to the whole body of science, it has become necessary to search for the causes which brought modern historical writing into being in the results of that great period of transformation which marks the beginnings of the present social and intellectual order, namely, the «Commercial Revolution.» By this term is meant that vast movement of exploration and discovery, which occurred in the three centuries from 1450–1750, and its almost incalculable social and intellectual consequences. The isolation, repetition, stability and provincialism of the old order could not endure in the face of the widespread contact of different cultures — that most potent of all forces in arousing intellectual curiosity and promoting radical changes of every sort.

The reaction of the commercial revolution upon historiography was in no way more notable and far-reaching than in regard to the scope of the historian's interest. The narrowness and superficiality of the field of historical investigation since the canons of Thucydides and Orosius had come to prevail could no longer endure unimpaired; it meant the beginning of the return to the field that Herodotus had to some extent marked out for the historian. Writers to some degree ceased to be absorbed by those most superficial phases of political and ecclesiastical history, which had hitherto claimed all of their attention, and became for the first time interested in the totality of civilization. It meant a much greater impulse to that broadening and secularizing process which had been revived by humanism. Not only were there great stores of knowledge to be obtained from the contact with the older civilizations of the East, but in the natives, historians and philosophers at last found the «natural man,» who had hitherto only existed in the mythical period before the «Flood.» No greater contrast could be imagined than the vast difference in the type of subjects which interested such an historian as Pufendorf and those with which Oviedo concerned himself. Again, the new range of historical interests offered some opportunity for originality of thought; there were fewer erroneous notions to handicap the writer at the outset. Neither Thucydides, Polybius and Livy, nor Augustine and Aquinas had provided the final authoritative opinion on the marriage customs of Borneo or the kinship system of the Iroquois. The only exception in this respect was the prevalent doctrine of a «state of nature,» which had come down from the Stoics and Roman lawyers and now seemed to have practical concrete confirmation.

While the influence of the commercial revolution upon historiography was most effective indirectly, through the intellectual and social changes which it produced, and the reaction of these changes upon historical interests and methods, there were some important immediate and direct results apparent in historical writing among those who dealt with the record of the discoveries. In the first place, there were radical changes in style and exposition. The old arrangement in the form of annals was no longer suitable; what was needed now was a vehicle for comprehensive description and not for chronological narration. The majority of the early historians of the movement of exploration and discovery were practical men of affairs and wrote in a direct and unpretentious style. Though there was later, with such writers as Herrera, a tendency to lapse into the literal canons of humanism, an important breach had already been made with both the form and the style of the conventional historical literature. The content of historical products was also greatly altered by these writers; political and ecclesiastical intrigues were replaced by a comprehensive account of the manners and customs of a people. This tendency reacted strongly even on those writers who dealt exclusively with European affairs. The 'Chronicle' of Eusebius or the genealogy of reigning monarchs, as the introduction to historical works was generally displaced by a description of the land and its inhabitants. Excepting only the feeble advances of Æneas Sylvius and his numerous German disciples, for the first time since the days of the Ionic historians of the 5th and 6th centuries B.C., ethnography and geography began to make a feeble appearance in historiography. Finally, though the earlier of the members of this school of writers were primarily collectors of descriptive information, they later became speculative, and with Voltaire and Herder there appear attempts at a world history conceived according to the new orientation and possessing some degree of comprehensiveness and grasp of causal forces.

As historiography was completely dominated by the canons of humanism at the beginning of the period of discovery, it was natural that the earliest of the historians of the commercial revolution should be humanists who turned their attention to the new movement. Their style and arrangement of material, however, had to be altered to some extent, and the centre of interest was profoundly changed. The first of these writers was Peter Martyr d'Anghiera (d. 1526), an Italian humanist who devoted himself to a description of the new world which had just been revealed. His 'Decades of the New World' showed a fine power of descriptive composition, which sacrificed humanist conventions when necessary. While exhibiting no profundity and little critical ability, it was a well-proportioned and fairly complete summary of the extant reports regarding the new civilizations. Its great significance lies in the fact that it was the first work by an historian which described the civilization of a people without founding it upon the narrow and cramped basis of political life or religious activities. A more truly historical work and the most objective production of the period was the 'General and Natural History of the Indies' of Gonzalo Fernández de Oviedo (1478–1557), a Spanish naturalist who turned historian — a sort of early Alfred Russell Wallace. He was highly critical in recording his own observations, but was equally credulous in accepting tales told to him by others. His work contained a vast amount of information which was generally reliable. In his direct and matter-of-fact narrative there was nothing of the form of humanism, but his style was slovenly and the organization of material miserable. It was the least artistic and the most scientific work of this early group. At the opposite pole as to accuracy stood the notorious work of the Dominican bishop, Bartholomew de Las Casas (1474–1566) — the «William Lloyd Garrison of the 16th century.» He was a biased and pedantic scholastic doctrinaire of a thoroughly mediæval type. His 'History of the

Indies,' idealized the natives without bounds and tremendously exaggerated the cruelty of the conquerors. It was worse than worthless for either history or ethnography and did not even possess the merit of an agreeable style. Infinitely superior was the 'General History of the Indies' of Francisco López de Gómara (1510–c.1560), the ablest historian of this school. He showed an admirable combination of excellent descriptive style with relatively high critical ability. His work would have been the great history of the discoveries had it not been vitiated by personal considerations. He was employed by the family of Cortés and was compelled to devote more space to the history of the conquest of Mexico than to all other events combined, and was also compelled to refrain from candid criticism in this major portion of his work. The great «popular» history of the period of discovery was the 'General History of the West Indies' of Antonio de Herrera (1549–1625), the official historian of Philip II. This work was the best example of the lapse of the early descriptive narrative into the conventions of humanist style. He even adopted the annalistic arrangement and everywhere subordinated subject-matter to external form. This meant that his work was greatly inferior to some of the earlier ones in its descriptive material as well as in critical method. It became the popular authority and did more than any other work to establish the generally accepted ideas concerning the discoveries and the great figures connected with them. Next to the work of Las Casas the least meritorious product of this school was the 'Commentaries on the Incas,' by Garcilaso de la Vega (1540–1616), the son of a Spanish adventurer by a native Peruvian mother. He was honest but entirely destitute of critical powers. Adopting the stye of the humanists, he constructed an utopian picture of ancient Peru which was exaggerated beyond comparison.. His almost worthless picture of the Incas gained great vogue in the 17th and 18th centuries when such idealistic views of native populations were so popular. In passing, there might be mentioned the bumptious and boastful 'General History of Virginia and New England' by Capt. John Smith. The first work to deal with the exploration and settlement of India and the «Far East» by Europeans was the 'Da Asia,' of the Portuguese colonial official and historian, João de Barros (1496–1570). Published in fragmentary form in 1552, it described the Portuguese explorations in Asia. It was, perhaps, the best literary product among the histories of the period of discovery, and, though somewhat apologetic in tone, remained for a long time the chief source of information on the subject. A century and a half later Engelbrecht Kaempfer (1651–1716) provided the first systematic account of the early European contact with Japan. He was a German physician who visited Japan and his manuscript 'History of Japan,' published in 1727, remained the chief popular source of European knowledge regarding that country for a century, and was extensively used by Charlevoix. The French Jesuit, Pièrre François Xavier de Charlevoix (1682–1761), not only compiled histories of the Jesuit missionary enterprises in Japan on the basis of the works of Kaempfer and others, but also wrote voluminously of the French explorations in America from personal observation and first hand contact. His 'Histoire et description générale de la Nouvelle-France' (1744), though prolix and uncritical, was highly interesting and enjoyed a long popularity. The general reaction of the influences growing out of the period of discoveries and the commercial revolution upon this school of historians was best summed up in 'The Philosophical and Political History of the Settlements and Trade of Europeans in the East and West Indies,' by the promoter and pamphleteer, Guillaume Thomas Raynal (1713–96). Published in 1771, it was not only somewhat of a synthetic compilation from earlier works, but also indicated the reaction of the commercial revolution upon European thought by its emphasis upon the significance of commerce in modern history and by its surcharge of 18th century political philosophy concerning the rights of man, liberty and the state of nature. But important as some of these writers may have been in altering the conventions of style and the interests of the historian, the general effect of the commercial revolution upon historiography was less vital in the production of historians of the discoveries than in the alteration of all phases of life in the succeeding centuries which grew more or less directly out of it and indirectly wrought great changes in historical concepts and methods.

2. The Reaction of the New Scientific Philosophy upon Historiography.— None of the indirect influences of the commercial revolution upon historical writing were more important and more obvious than its aid in producing that new philosophy of nature of which Bacon and Descartes were the most conspicuous exponents. The results of the explorations of all the major portions of the earth's surface had not only demonstrated the great extent of the habitable portions of the globe, but had also shown that the supposed marvels and terrors in the unexplored regions were but an unfounded myth which quite failed to materialize. At the same time that De Gama, Columbus and Magellan were revealing the extent and nature of the surface of the globe, less picturesque figures were devoting themselves to an exploration of the universe, with results equally disastrous to the older theological traditions. The vast and immeasurable extent of the universe was apprehended to an elementary degree by Copernicus, Galileo and Tycho Brahe. The notion of an orderly arrangement and functioning of the universe was established by the great laws of mechanics, discovered and formulated by Galileo, Kepler and Newton. To these major advances in science should be added the explanation of the now commonplace natural phenomena through the great advances in every field of natural science in the 17th century. The net result of all these notable advances was a serious challenge to the old theological interpretations, based primarily upon the concept of a «God of arbitrariness,» who was continually varying or suspending the laws of the universe to punish a recalcitrant prince or to answer the prayer of a faithful bishop.

The general implications of the above scientific discoveries were reduced to a systematic body of philosophical thought by Francis Bacon and René Descartes. Bacon especially emphasized the necessity of following the inductive method and Descartes attempted a mechanical interpretation of the universe. The new discoveries and the new philosophy tended to produce a rationalistic interpretation of natural and social phenomena which abruptly challenged the older and generally accepted view of miracles and wonders that had been so popular with Christian historians during the mediæval period. The English Deists, such as Cherbury, Blount, Locke, Shaftesbury, Woolston and Hume, forever discredited the doctrine of the miraculous. Finally, with the attacks upon the traditional views of the composition of the Old and New Testaments by Hobbes, Spinoza, Astruc and Reimarus, the philosophy of wonder-working was undermined, not only through the evidence of natural science, but by questioning the authenticity of the Scriptural accounts in which the miracles were recorded. The gradual growth of toleration, especially in England, during the latter part of the 17th century and the opening of the 18th centuries enabled these revolutionary ideas to obtain an adequate expression and a general currency.

It was also inevitable that the new scientific discoveries and the new philosophy of nature should react profoundly upon the contemporary social philosophy. The idea of orderly development and continuity in social as well as natural processes was comprehended by Vico, Hume and Turgot. The older idea of social evolution as a gradual decline or retrogression from a primordial «golden age» was replaced in the writings of Vico, Voltaire, Hume, Turgot, Kant, Godwin and Condorcet by the concept of continual progress from lower stages of civilization. The need for miracles to justify history and the other sciences dealing with human activities was lessened by the growing prevalence of the Deists' doctrine of the inherent and reasonable «decency» of man — a notion widely at variance with the older views of the «Fathers» and of Calvin, which maintained the hopeless depravity of mankind. Finally, the new discoveries and the secularization of natural and social philosophy produced a great extension of the interests of the historian beyond the field of politics and religion. In the writings of Voltaire, Raynal, Montesquieu and Heeren it became apparent that the impulse to a broader and sounder scope of history had begun to affect others than those who described the course of the explorations. Though this healthy tendency toward a wider field of historical investigation and narrative was to some extent checked by the renewed impulse to political history with 18th and 19th century nationalism, it had gained a foothold from which it was not entirely dislodged until it was overwhelmingly reinforced by the expansion of interest in social, economic and intellectual topics after the industrial revolution and its social and intellectual consequences in the 19th century.

The reaction of this philosophy of the new natural science and of the new social philosophy upon historiography appears in the writings of what is conventionally known as the «Rationalistic School» of historians, or the historians of the «Aufklärung.» While the writings of this school varied so greatly that it is customary to divide the writers into several groups, there was a fundamental unity of method and interest which makes it possible to summarize the general nature of the rationalistic historiography of the 18th century. Much the most important innovation of this school was their uniform tendency to broaden the field of history, so that it would extend beyond the political intrigues of church or state and embrace the history of commerce, industry, and civilization in its widest aspects. The historians of the discoveries had shown a similar tendency, but their work had been confined to a discussion of the new world and they had not constituted a general European school of historians. With the rationalists, no matter what the period or country dealt with, there was an effort to adopt a broad cultural approach to history and to infuse embryonic sociological principles into historical analysis. Scarcely less important was their attempt to discredit superstition and the theological theories of historical causation, and to substitute for these purely natural causes. Their general theory of historical causation was crude and elementary, being the notorious so-called «catastrophic theory of history,» whereby great movements or policies are accounted for as the result of a single personal act or of some isolated natural or political event. Being the first attempt in the history of historiography to provide a purely natural theory of causation, it was bound to be imperfect and unsatisfactory, but it was a great advance over the previous theory of supernatural or miraculous causation. It led, however, to an exaggerated emphasis upon the possibility of abrupt and artificial changes in social and political institutions. The «Romanticists» arose primarily as a reaction against this particular phase of the historical doctrines of the rationalists. Even the political history of the rationalists was given a new and more promising cast. It was no longer limited to the field of political apologetics, but became a truly critical political history as far as its attitude towards policies was concerned. It was not usually written by members of the governing classes nor under their patronage, but by representatives of the new bourgeoisie or third estate, who had little influence in the several European governments at that period. It became an agency of criticism and of agitation for reform but rarely for revolution. It must be remembered, however, that the critical powers of the rationalists were limited almost wholly to their attitude towards the general subject-matter of their history and were not exhibited to any comparable degree in their handling of the sources of information. As research scholars in the use and criticism of printed and manuscript documents they did not even approximate the level of the school of Mabillon.

The founder of the rationalistic school of historians and the master mind of the movement was François Arouet, more commonly known as Voltaire (1694–1778). The two dominating factors in Voltaire's political and historical philosophy were his great admiration for the English civilization of his time and his peerless powers as a critic. An apologist of an enlightened despotism allowing the free development of bourgeois culture and prosperity, he saw in the England of Walpole his political ideal, and his agitation for reform in France was limited wholly to a desire to create in France what he beheld in England. As a critic he has never been equalled in any age, primarily because of the fact that he was utterly devoid of reverence or respect for any institution and was, thus, wholly free to give full expression to his reactions against every phase of obscurantism. His most finished historical work was the 'Siècle de Louis XIV,' which Fueter describes as «the first modern historical work.» In it he broke wholly with the annalistic, and even with any strict chronological system, and for the first time divided an historical work in accordance with the topical system of arrangement. Again, it was the first time that the civilization of a great European state had been described in its totality. Voltaire's work was no mere skillful compilation; it was an attempt to exhibit the main currents of development in the whole life of a powerful state and a cultured society. As was the case with all the internationally-minded rationalists, there was little of that chauvinism in his work which disfigured the work of the political historians of the following century. Much less thorough, but equally significant was his 'Essai sur les Moeurs,' generally regarded as the first universal history in the true sense of the term. It was planned as a vast «Kulturgeschichte» of all ages and peoples. While Voltaire did not possess the knowledge or the leisure requisite for its execution and the work was ill-proportioned and marred by serious and almost fatal omissions, it was, nevertheless, one of the great landmarks in the development of historiography. It was the real foundation of the history of civilization in its modern sense; it was the first work in which credit was given to the non-Christian contributions, especially of the Arabs, to European civilization; it first put political history in its proper relations to economic and social history in the general development of humanity; and it silenced forever the theological and providential interpretations which had prevailed from Orosius to Bossuet. The most fundamental point in his philosophy of history, the notion of the «genius of a people,» was later adopted by the Romanticists, with some grotesque exaggerations, in their conception of a «folk-soul.»

Voltaire's point of approach found several distinguished representatives in England. There was one important difference, however; among the English writers there was no underlying impulse towards reform. In the case of the English historians of the period there was that same complacent self-satisfaction over the final perfection of English institutions that was evident in the legal works of Blackstone which aroused the fury of Bentham. The best example of this tendency was David Hume (1711–76). His 'History of England from the Invasion of Julius Cæsar to the Revolution of 1688' gave Englishmen an interpretation of their national history conceived in the spirit of an urbane and dispassionate sceptic. Unlike the work of Voltaire, Hume's history was most superficial in its content and analysis. It was in no way a history of English civilization, and even the political history was superficial and inaccurate. The section on the mediæval period was practically worthless. Its only merit was in its treatment of the Stuart period, for which it provided the first truly historical and analytic interpretation of the great Civil War. His point of view was wholly insular and he was probably the least universal of the rationalist historians. A much abler historian was the Scotchman, William Robertson (1721–93), the most avowed of Voltaire's English disciples. Of his three major works, 'The History of Scotland'; 'The History of America'; and 'The History of the Reign of the Emperor Charles V,' the latter, especially its introduction, was the most significant in the development of historical writing. Its lack of exhaustive scholarship is revealed by the fact that the author never learned to read German, but he made the best possible use of the sources he employed. He was the first to make clear the major outlines of the constitutional development in the Middle Ages and was one of the earliest to appreciate the cultural contributions of the mediæval Church. He was, however, the most decided of the exponents of the catastrophic theory of historical causation and to him is mainly due the prevalence of the exaggerated notion of the importance of the Crusades in every phase of the later culture and politics of Europe and also the further elaboration of Baronius' notion of the special significance of the year 1000. The member of the English school who has gained the most enduring and general fame was Edward Gibbon (1737–94): Generally estimated by critics as less able than Robertson, he was a classic example of the attainment of great success through ministering to the prevailing sentiments of his time, in the possession of an appealing subject, a fine classic style and the current complacency and mild rationalism. His 'Decline and Fall of the Roman Empire' dealt with a topic which was charged with an age-old thrill and a compelling interest. Less profound than Voltaire and much less significant for the history of historiography, Gibbon has won a more permanent reputation as a historian on account of causes readily understood. In addition to the more attractive and universally interesting subject with which he dealt, it was also a much more restricted subject, and, possessing abundant means and leisure, Gibbon was able to master most of the then available sources on his topic. The outstanding significance of his work consisted in the fact that it contained the first wholly secular and impartial study of the rise and expansion of Christianity. Possessing a cold and reserved personality he was not bitterly hostile, but divested Christianity of its traditional envelope of unique supernaturalism and treated it as he later dealt with the spread of Mohammedanism. The general outlines of his picture have never been superseded.

In Germany Voltaire found three followers in Schlözer, Schmidt and Spittler. While August Ludwig Schlözer produced a minor attempt at a universal history, his main work was done in the history of Slavonic Europe, where he found his ideal in the enlightened despotism of Catherine II. He had very limited powers of criticism, especially in regard to biblical matters; had no imagination and an unattractive style; but he was far the greatest philologist of the rationalist school. What Voltaire did for France, Hume for England, and Robertson for Scotland, was done for Germany by Michael Ignatz Schmidt (1736–94). His 'History of Germany' was one of the most finished products of rationalism in historical literature. His style was excellent; he was cautious and accurate in the use of his sources and was free from all chauvinism; he was the first to handle the German Reformation in an impartial manner; and the scope of his work resembled Voltaire's in being a true history of civilization. The smaller German states and the Christian Church found their rationalist historian in Ludwig Timotheus Spittler (1752–1810). His work was best in dealing with very recent times. He idealized the Middle Ages, and to him is primarily due the origin of that rosy and romantic conception of the mediæval period as one in which the main events were tournaments and the chief figures were the trouvères, troubadours and minnesingers. He was the first writer to handle the whole history of the Church from the rationalist standpoint. His criticism was relatively mild, but he adopted the peculiar attitude of judging the Church from the viewpoint of an instrument for advancing the cause of rationalism.

The discussion of the contributions of the school of Voltaire would not be complete without a brief reference to the work of two writers not technically historians. Though the 'Scienza nuova' of Vico (1668–1744) undoubtedly contained the first definite anticipation of the modern dynamic theory of progress, he was too pious in his theology to be listed among the colleagues of Voltaire. Such was not the case with Turgot and Condorcet. In his discourse at the Sorbonne in 1750 on 'The Successive Advances of the Human Mind,' Turgot (1727–81) first set forth clearly the doctrine of continuity in history, the cumulative nature of progress and the causal sequence between the different periods of history — theories later so greatly emphasized by Mr. Freeman. An equally notable work was Condorcet's (1743–94) 'Historical Sketch of the Progress of the Human Mind,' which contained the best statement of the 18th century doctrine of progress and perfectibility. Less thorough-going echoes of this doctrine were heard from Kant in Germany and Godwin in England.

The rather advanced rationalism of Voltaire and his school could scarcely gain a general acceptance and a sustained success in the 18th century, when it was greatly beyond the general level of contemporary thought. It had also many crudities inseparable from the first courageous attempt to reconstruct history and bring it in harmony with the contemporary progress in scientific thought. It was natural, then, that there should be a reaction against many of its premises and methods, which was in part a recrudesence of obscurantism and in part an effort to correct some of the errors of the school of Voltaire. The stages in this reaction were gradual and clearly marked. It passed through the more moderate and conservative rationalism of Montesquieu to the almost irrational sentimentalism of Rousseau, and ended in the mystic and idealistic vagaries of romanticism. The school of Voltaire did not come to its own until it was revived with greater profundity by Buckle, Lecky, Morley, Stephen and White, as a result of the reaction of 19th century science upon historiography.

While Montesquieu's works as examples of historical criticism and accuracy are almost worthless, his broader attitude toward general methodology was of the utmost significance. He was not at all violent or revolutionary in his political theory, and his literary affinities were with humanism rather than rationalism. He did, however, present certain phases of thought which were a marked improvement over Voltaire. Accepting Voltaire's unanalyzed doctrine of the "spirit of a people," he tried to show how this was produced by the operation of natural forces, particularly of climate, and first brought out clearly the fundamental proposition that the excellence of social institutions must be judged, not by an arbitrary and absolute standard, but by their relative adaptability to the spirit of the people for whom they serve or are intended to serve. Again, where Voltaire and his followers had dropped only casual reflections, Montesquieu offered a synthesis of the various factors of historical development, which, though crude, marked a considerable methodological advance. Finally, while the school of Voltaire had introduced the treatment of commercial factors in connection with political development, Montesquieu and his followers laid much more stress upon the great influence of commercial activities in the life of the state. The school of Montesquieu most faithfully represented the reaction of the commercial revolution on European historiography.

Being primarily a political philosopher rather than a historian, Montesquieu's disciples were more numerous among the political theorists than among the avowed historians. J. L. Delolme's 'Constitution of England'; Adam Ferguson's 'History of Civil Society,' and Joseph Priestly's 'First Principles of Government' were works that clearly exhibited the principles of Montesquieu in the field of political philosophy. But if Montesquieu had few disciples among historians, he had at least one of the highest order in Arnold Hermann Ludwig Heeren (1760–1842), one of that brilliant group of Göttingen professors of the period. His great work was entitled 'Thoughts Concerning the Politics, Intercourse and Commerce of the Leading Nations of Antiquity.' Its principles were those of Montesquieu improved by the more scientific analysis of economic life in the works of Adam Smith. With great skill he attempted to reconstruct the commercial life of antiquity and to indicate its hitherto unsuspected influence upon the course of the history of the various nations. Heeren was one of the best writers among historians. Abandoning all attempts at rhetorical flourish, he produced a most thoughtful work written with great clarity and coherence. Edouard Meyer, the greatest of authorities on the history of the ancient nations, has called Heeren the leader of all who have subsequently attempted to deal with this field.

Much less sound was the remaining group of the rationalist school, that which followed the lead of Rousseau and formed the logical transition from rationalism to romanticism. There were a number of important differences between Rousseau and Voltaire in their attitude toward historical and social problems. In the first place, Voltaire was purely intellectual and critical and little moved by sentiment; Rousseau was almost pathologically emotional, sympathetic and sentimental. In the second place, Voltaire was realistic and practical; Rousseau was idealistic and utopian. Finally, Voltaire wrote from the standpoint of the bourgeoisie, praised enlightened despotism, and had little faith in the political ability of the illiterate masses; Rousseau wrote as an ardent exponent of the release of the masses from despotic political power. Until the period of the French Revolution, Rousseau's views could gain little currency in France for the intellectual circles were controlled by aristocrats, but in Germany he found several enthusiastic disciples.

The most attractive of Rousseau's German disciples in the field of history was the poet-dramatist-historian Friedrich Schiller (1759-1805), whose chief works were the 'History of the Rebellion of the Netherlands against the Spanish Rule' and 'The History of the Thirty Years War.' His works presented a combination of the sentiment and pathos of Rousseau with the native powers of a great dramatist and poet. In his history of the Dutch revolt he found the basis of an epic of deliverance from oppression, while in the description of the Thirty Years' War he saw in Gustavus Adolphus and Wallenstein the central figures for a great historical drama. It scarcely needs to be pointed out that in his grand epic and dramatic themes there was no place for the commonplace description of the elements of culture and civilization. He had great power of clear preliminary analysis of political movements, but once his narrative got under way the poet and dramatist gained complete control over the historian, and his work, like that of Carlyle, was a contribution to great literature rather than to historiography. A much more influential historian among contemporaries, but incomparably inferior in every sense to Schiller, was Johannes Müller (1752-1809). His most famous work was the 'History of the Swiss Confederation.' Though possessing a memory rivalling Macaulay's and a zeal for the study of sources comparable to that of Coulanges, he lacked wholly Macaulay's power of analysis, organization and narrative, and had none of the critical power of Coulanges. Though he read all the available sources, he not only lacked in organizing ability, but was also so devoid of critical powers as to be unable to detect and exclude contradictions in his own narrative. To Rousseau's sentimental devotion to liberty he added a pedantic imitation of classical rhetoric. His Swiss history became an epic of freedom combining the methods of Rousseau and Livy. His 24 books of general history were significant only in that they contributed to the exaggeration of that radically erroneous conception of the general «Gemütlichkeit» of the Middle Ages, which had been given a powerful initial impulse in the work of Spittler. Rather a representative of several of the phases of the rationalistic historiography than a complete disciple of Rousseau was Johann Gottfried Herder (1744-1803). His notable work — 'Reflections on the Philosophy of the History of Humanity' — was a composite of many current doctrines. It combined Rousseau's exaggerated enthusiasm for the state of nature and freedom from authority, Voltaire's conception of the reality and permanence of national character, Montesquieu's doctrine of the relation between national character and physical environment, and the theological conception, later expanded by Hegel, of the gradual development of humanity toward a state of freedom. His zeal for the state of nature and the natural man led him to restrict his discussion chiefly to primitive peoples. His particular emphasis upon the fixity of national character and the organic unity of national culture put him in direct line with the romanticists. Friedrich Christoph Schlosser (1776-1861) took over Rousseau's conceptions through the intermediary of Kant's «categorical imperative.» In his 'History of the Iconoclastic Emperors' and his unfinished 'History of the World,' he anticipated the attitude of Lord Acton and passed judgment on historical events and figures according to the principles of the Kantian precepts of individual morality. His work had a sombre cast, due to his inordinate passion for Dante's 'Divine Comedy,' and his works were full of harsh and hasty criticisms of a purely subjective nature. He was not a critical scholar and he ignored social and economic history. His chief significance lies in the fact that he was one of the first notable historians to lay great emphasis upon the political importance of a national literature.

3. Romanticism and Historiography.—Even before Louis XVI had issued the royal edict directing an election of delegates to an «Estates-General,» the reaction against the frank and direct rationalism of Voltaire had definitely commenced in the works of the above-mentioned disciples of Rousseau. To the conservative element it seemed that the events of the French Revolution had finally demonstrated the futility of the rationalistic doctrines of catastrophic causation and the possibility of altering social institutions through the application of a few «self-evident dictates of pure reason.» Unfortunately, this laudable attempt to correct the artificiality of the dogmas of Voltaire led to a reaction in the opposite direction which was even less valid and progressive than the theories of the rationalists. Romanticism in historiography meant a decided retrogession in the direction of obscuranticism, and was an integral part of that reaction in social science which is chiefly identified with the names of Burke, De Bonald, De Maistre and Von Haller. The basic historical premise of the historiography of romanticism was the doctrine of the gradual and unconscious nature of cultural evolution. It proclaimed the unique organic unity and development of all forms of national culture. There was a decided mystic strain in their thinking which maintained that the unconscious creative forces moved and operated in a mysterious manner which defied rationalistic analysis. It was held that all were subject to the operation of these mysterious forces of psychic power, which were later termed by Ranke, the «Zeitgeist.» Great emphasis was laid upon tradition and the alleged «ideas» which went to make up this spirit of the age and of the nation. These conceptions naturally led to a dogma of political fatalism which represented the individual or the nation as powerless before the mass of creative spiritual forces. Revolution was represented as particularly wicked, futile and worthy of special condemnation. There grew up that philosophy of political «quietism,» which fitted in excellently with the current *laissez-faire* doctrines of the economists and political theorists. Out of this tendency there developed that notorious and specious myth representing the Anglo-Saxon peoples as the perfect examples of political quietism, and, hence, of inherent political capacity, while an equally erroneous doctrine pictured the French as the typical example of a revolutionary and unstable nation utterly devoid of all political capacity. This fundamental error did more than anything else to mar the accuracy of 19th century political history and philosophy and has not even yet been fully eradicated. Again, the idea of the pure, indigenous and spontaneous nature of national culture led to a narrowing of that cosmopolitan outlook of the rationalists and the centering of attention on purely national history. Further, for each nation the period of particular fertility for historical research was held to be the Middle Ages. This tendency was due in part to the strange misconception that this was the period of the fixing of the several national cultures and in part to the psychic affinity of the romanticists with the mediæval mental reaction to the problems of existence and causation. Language was believed to be the vital mark or criterion of nationality. This doctrine took its deepest root in Germany where language was almost the only bond of nationality, and it led to the great researches in philology associated with the names of Humboldt, Wolf, the brothers Grimm and Lachmann. On account of the fact that the romanticists maintained the hopelessness of any detailed analysis of historical causation, their philosophy of history ran in a «vicious circle.» Without giving any scientific explanation of the development of the spirit of a nation, they attributed the peculiarities of national institutions, laws, literature and government to the genius of the nation, and then represented national character as the product of the art, literature, laws and institutions of a people. But in spite of the semi-obscurantic tendencies and the philosophical crudities of the romanticists, they must be given credit for having done much to correct the vicious catastrophic theory of the rationalists, and for having emphasized the element of unconscious growth in historical development and the vital truth of the organic unity of a cultural complex. It was left for Lamprecht, nearly a century later, to take over what was really valuable in the romantic doctrines and work them over into his famous theory of historical development as a process of transformations and mutations within the collective psychology of both the nation and humanity.

The expressions of romanticism in historiography were many and varied. Its doctrines were employed in the field of the investigation of legal origins by Karl Friedrich Eichhorn (1781–1854), whose 'Political and Legal History of Germany' was devoted primarily to the study of early German law; and, above all, by Friedrich Karl von Savigny (1779–1861) in his 'History of Roman Law in the Middle Ages,' which was the most able and dogmatic defense of the conception of law as a product of the national «genius» of a people. In the field of the history and analysis of religion and literature it received its most notable expression in François Rene Auguste de Chateaubriand's (1768–1848) 'Genius of Christianity'; in Madame de Staël's (1766–1817) 'Literature in Its Relation to Social Institutions'; in Abel François Villemain's (1790–1870) 'Sketch of the Eighteenth Century,' and in the 'History of German Poetry' by Georg Gottfried Gervinus (1805–71). Romanticism entered the philosophy of history in the works of Friedrich Schlegel (1772–1829), F. W. J. Schelling (1775–1854) and Georg Wilhelm Friedrich Hegel (1771–1831). Schlegel viewed the historical process as the gradual restoration in man of the lost image of God through the operation of a divinely revealed religion. Schelling interpreted historical development as the gradual revelation of God through the operation of the unconscious forces of creative genius. Hegel's 'Philosophy of History' was founded upon his dialectic system of antithesis followed by synthesis, and upon his spiritualistic interpretation of history as «the necessary progress in the consciousness of liberty.» Working from these premises he adapted the facts of history in such a way as to portray the successive migrations of the «Weltgeist» from the Orient to Lutheran Germany, bringing with it a continually expanding consciousness and realization of liberty. Hegel's rather grotesque system was purged of its most apparent crudities and applied with much greater learning and accuracy by Ferdinand Christian Baur (1792–1860) to the history of Christianity, and by Edouard Zeller (1814–1908) to the reconstruction of early Greek philosophy. The narrative school of romanticist historians was not only dominated by the general theories enumerated above, but by the literary canons of the historical novels of Walter Scott with their great emphasis upon the element of «local color.» This tendency was really anti-historical, in that it aimed primarily to destroy all sense of historical perspective and to portray episodes or periods in the past in such a manner as to make them have the vividness and intimacy of contemporary events. It was a contribution to literature rather than to scientific history. Its only real impulse to improved historical writing lay in the fact that its literary attractiveness awakened an interest in history on a wider scale than ever before, and brought into the field many eminent scholars whose individual contributions to historical knowledge were greater than those of all of the narrative school of romanticists combined. Of this variety of narrative romanticist historical writing the most important products were the 'History of the Conquest of England by the Normans' and the 'Narratives of the Merovingian Period' by Augustin Thierry (1795–1856); the 'History of the Dukes of Burgundy' by Baron de Barante (1782–1866), and the 'History of the Italian States' by Heinrich Leo (1799–1878). A still further intensification of the subjective element in the narrative school was reached in the works of Michelet, Carlyle and Froude, where an attempt was made not only to bring the reader in immediate touch with the setting of the events narrated, but also with the personal impressions and attitudes of the author. The 'History of France' of Jules Michelet (1798–1874) was the greatest product of French historical literature. The author was dominated by a passionate attachment to his country, possessed a marvelous creative imagination and a style notable for its word painting and its power of symbolical presentation, and stood forth as the great historical apologist for French democracy. The best portions are those dealing with the picturesque figures of the Middle Ages and the scenes of the French Revolution. The least attractive personality of the group and the least worthy as a historian was Thomas Carlyle (1795–1881). In radical contrast to Michelet he was possessed of a sour contempt for the masses and an equally exaggerated interest in the picturesque figures of history. To him history was but the collective biography of the conspicuous figures through the ages, and he was responsible more than any other historian for the conventional disdain of the modern historian for those commonplace things of daily life which have had incomparably greater influence upon social development than the picturesque personalities. Carlyle indulged his prejudices in his 'Letters and Speeches of Cromwell,' his 'History of Frederick the Great' and his 'French Revolution.' While possessing only moderate value as sources of information, on account of the writer's uncontrolled prejudices and his utter lack of critical method, they earned him the undisputed position as «the greatest of English portrait painters.» While his name has been adopted to designate chronic inaccuracy in historical investigation, Carlyle's disciple, James Anthony Froude (1818–94), was a much abler historian than his master. His faults were those of one constitutionally rather than carelessly or intentionally inaccurate, as he had a keen appreciation of the value of critical methods and his work was the first extended English history written on the basis of unpublished documents. His 'History of England from the Fall of Woolsey to the Defeat of the Spanish Armada' was an epic of English deliverance from the «slavery of Rome,» and his Carlylian attraction for great personalities found ample scope for expression in his portraits of Henry VIII and Burleigh. As a writer he was approached among English historians only by Macaulay. «No other English historian,» says Gooch, «has possessed a style so easy, so flowing, so transparent.» America found its sole distinguished representative of the school of Carlyle and Froude in John Lothrop Motley (1814–77), who devoted his life to a narration of the struggle of the Netherlands against Spain. Surpassing even Freeman in his passion for liberty, he found a most congenial subject in tracing the successful revolution of the Dutch and the establishment of their republic. For word painting and vivid description of dramatic scenes only Carlyle has equalled him among historians writing in the English tongue. While the conceptions of romanticism gained some dominion over the minds of greater scholars, such as Ranke, they served rather to stimulate the author's interest in history than to vitiate his scholarship. With its emphasis on the doctrine of the «genius of a nation» and its deep emotional basis, romanticism was a powerful influence in stimulating the nationalistic historiography which dominated the historical writing of the 19th century.

4. Nationality and Historiography.— The commercial revolution not only was the main factor in arousing historical interest in non-European peoples and a powerful impulse in the development of the new natural science and its accompanying sceptical philosophy, but was also the chief force in bringing to completion the process of shaping the modern national states out of the great feudal monarchies of the later Middle Ages. By its contributions to the increase of the capital and resources at the disposal of the monarch, and its creation of a loyal middle class, it enabled the kings to provide a hired officialdom and military force, by means of which they could crush the opposition of the feudal nobility and bring to perfection the modern national state. The psychological impulses arising from the welling-up of national pride in the newly fashioned states led to the production of narratives glorifying the national past and to feverish activity in collecting the sources of information which preserved the priceless records of the achievements of the nation from the most remote period. While this movement, in its earliest phases, goes back to the 16th century it took on its modern form after the French Revolution, the Napoleonic Wars and the regeneration of Prussia had contributed so greatly to the creation of an ardent national self-consciousness in most of the European states. Coming at this time, it was reinforced by the then popular tenets of romanticism emphasizing the importance of national character and the imperishable «genius of a people.» The nationalistic impulse was refreshed from another source in the middle of the 19th century by the vicious influence of the notorious 'Essai sur l'inégalité des races humaines,' published by Count Joseph Arthur of Gobineau (1816–1882) in 1854. It proclaimed the determining influence of racial differences on the course of historical development, asserted the inherent superiority of the «Aryan» race, and held that racial degeneration was the inevitable result of its mixture with inferior races. His now utterly discredited doctrines gained great vogue among French, English, and especially among nationalistic German, historians and publicists, culminating in the Teutonic rhapsody of Charles Kingsley and Houston Stuart Chamberlain, the Gallic ecstasy of Maurice Barrès and the Saxon pæans of Kipling and Homer Lea. Not only was this doctrine effective in developing a still greater degree of chauvinism upon the part of the governing «races,» but it also led to the persecution of minority «races,» and the consequent stimulation of their nationalistic sentiments.

Perhaps the earliest state to begin a national history was Germany in the days of humanism and the old empire. The cultured Emperor Maximilian I (1493–1519) followed the example of Charlemagne in gathering to his court at Vienna some of the leading historical scholars of German humanism. Conrad Celtis revived an interest in the 'Germania' of Tacitus. Johannes Spiessheimer (1473–1529), better known as Cuspinian, made a critical study of the historical works of Jordanes and Otto of Freising. Irenicus, Peutinger and Beatus Rhenanus (1486–1547) exhibited the spirit of Blondus in their researches into German antiquities. Their activity was soon smothered, however, in the controversies of the Reformation, and interest in secular and national history waned. A century later Melchior Goldast (1578–1635) produced his famous collection of documents dealing with early and mediæval German history and public law, known as the 'Monarchia romani imperii,' which was the standard German collection until the 'Monumenta' had covered the same period and material in a more thorough fashion. The distinguished philosopher G. W. Leibnitz (1646–1716) was ambitious to provide a collection of the sources of German history which would rival those on French history which had been gathered by Duchesne. He was not, however, able to obtain the necessary imperial support and the project had to be abandoned. He merely produced a collection on the history of the Guelfs as a by-product of his history of the dynasty of Brunswick. The great modern collection of the sources of German history, the justly famous 'Monumenta Germaniæ Historica,' was a product of the spirit of the War of Liberation and was begun by that greatest of all the German statesmen of his time, Baron vom Stein. Discouraged by the reactionary tendencies of the period following the Congress of Vienna, Stein devoted his energies to the stimulation of popular interest in German history. Failing to obtain government support for a collection of the sources of German history, he raised the funds from the resources of himself and his friends, and with rare good fortune secured an editor of great scholarship and energy in the Hanoverian archivist, G. H. Pertz. Pertz carried the burden of the editorship for a half century, aided by the best of German scholars, most prominent of his colleagues being the constitutional historian, Georg Waitz. This magnificent and colossal compilation includes all the important sources of information regarding German history from the time of the Roman writers on the invasions, and is still in process of execution. It was, perhaps, one of the greatest landmarks in the development of scientific historical writing, as it alone made possible the productivity and accuracy of the succeeding generations of historians.

National history in Germany was not limited to the collection of sources, but received expression in glowing narratives which usually found their theme in the glories of the German imperial past of the mediæval period or in laudatory accounts of the Hohenzollern achievements, which served as the basis of enthusiastic proposals for a Prussian revival of the glories of the empire. Schmidt had written a history of Germany from the rationalist standpoint, but his cosmopolitan outlook made his work quite unsatisfactory to the patriots. Wilken initiated the nationalistic narrative by an account of German prowess in the period of the Crusades. Luden, under the spell of Johannes Müller's views of the mediæval period, produced a 'History of the German People,' in which he aimed to arouse national enthusiasm for the magnificence of mediæval Germany. Voigt contributed an epic dealing with the conversion and conquest of Prussia by the Teutonic knights. Raumer pictured the achievements of the Hohenstaufens, and Stenzel portrayed the deeds of the Franconian emperors with critical skill as well as patriotic edification. Giesebrecht analyzed the formation of the mediæval empire with a display of scholarship not less remarkable than his Teutonic fervor. Though his history of the Reformation was a powerful influence in making Luther the great German national hero, it must be admitted that Ranke and his immediate disciples shared something of the universal outlook of the rationalists, but with the rise of the "Prussian School" nationalistic history became even more chauvinistic and dynastic. Haüsser contributed a voluminous epic on the War of the Liberation in his 'History of Germany, 1786–1815.' Duncker, the historian of antiquity, from his work in editing the state papers of the great Hohenzollerns developed a fervid admiration for the dynasty which convinced him of its fitness to revive the imperial glories of old Germany. The first massive panegyric of Prussianism was the work of Johann Gustav Droysen (1808–84), who deserted his early liberalism to become an almost sycophantic eulogist of the Hohenzollerns. His monumental 'History of Prussian Policy' was marred not only by its grave prejudices in favor of the "mission" of the dynasty he admired, but also by the fact that it was almost wholly limited to the superficial field of Prussian foreign politics with little attention even to domestic policy, to say nothing of its total omission of the deeper social conditions and economic forces. The story was picked up where Droysen had left it by Heinrich von Treitschke (1834–96). His 'History of Germany in the Nineteenth Century' ranks with the histories of Michelet and Macaulay as one of the literary masterpieces of modern historiography. While it was charged with all of the vivid enthusiasm for Prussian leadership which marred the work of Droysen, Treitschke's work at least had the merit of devoting adequate attention to the fundamental cultural forces in national development. Heinrich von Sybel (1817–95), the third of the three leaders of the Prussian school, began his work as a disciple of Ranke by a brilliant work on the First Crusade and by a profound study of the origins of the German kingship, but the stirring political situation in the middle of the century led him away from the poise of his master and he became a thorough advocate of German unity through Prussian military leadership. His 'History of the French Revolution' was a massive polemic against the whole movement, and its central theme was the old romanticist dogma of the political incapacity of the French. From this spectacle of alleged political ineptitude Sybel turned to an account of the events which demonstrated the supreme capacity of his nation in political affairs — the foundation of the German Empire by Bismarck. His voluminous work on 'The Foundation of the German Empire by William I' showed wonderful power in the clear presentation of a mass of political and diplomatic detail, but was fatally disfigured by downright dishonesty in its presentation of Bismarck's foreign policy, from which all the criminal duplicity was carefully excluded. By the time Sybel had finished his work, history in Germany had become too weak a vehicle to serve as a leading instrument for advancing national aspirations. Its place was taken by the literary products of Peters, Tannenberg and the Pan-German expansionists; of Bernhardi and the ultra-militarists; and of Chamberlain and the blatant Teutonists. The complete complicity of the Prussian historians in the production of this state of national exaltation has been clearly revealed by Guilland.

Nearly a century after the beginnings of German national historiography at the court of Maximilian the French began to turn their attention to the analysis and collection of the sources of their national history. This movement may conveniently be dated from the publication of the 'Franco-Gallia' of François Hotman in 1574. Other early examples of this tendency were the ‘Antiquités gauloises et françoises’ of Claude Fauchet (1579); the ‘Annales Francorum’ of Pierre Pithou (1588); the ‘Recherches de la France’ of Etienne Pasquier (1611), and the material on the Crusades in the ‘Gesta Dei per Francos’ of Jacques Bongars (1611–17). The true beginning of the critical collection of sources was marked by the work of André Duchesne (1584–1640) in compiling the ‘Historiæ Normannorum scriptores antiqui’ (1619) and the ‘Historiæ Francorum scriptores coaetanei’ (1636f.); the ‘geneologies’ and the ‘Gallia christiana’ of the brothers Sainte-Marthe (1572–1650, 1655); the critical editions of Villehardouin and Joinville by Charles du Fresne du Cange (1610–88); and the ‘Capitularia regnum Francorum’ of Etienne Baluze (1630–1718). During the last half of the 17th century and the first half of the 18th this work of collecting sources was carried on almost entirely by the scholarly Benedictine monks of the Congregation of Saint Maur at Saint-Germain-des-Prés in Paris, which was founded between 1618 and 1630 by Doms Martin Tesnière and Grégoire Tarisse, and whose leader in historical scholarship was the great Jean Mabillon (1632–1707). Only a few of their more notable collections can be mentioned here. Dom Thierry Ruinart (1657–1709) prepared critical editions of Gregory of Tours and Fredegarius; Dom Edmond Martène (1654–1739) the ‘Thesarus novus anecdotorum veterum scriptores’ and the ‘Veterum scriptorum et monumentorum amplissima collectio’; Dom Bernard Montfaucon (1655–1741) ‘Les Monuments de la monarchie française’; Dom Martin Bouquet (1685–1754) the famous ‘Rerum Gallicarum et Francicarum scriptores,’ which is still being continued by modern scholars under the title of the ‘Recueil des historiens des Gaules et de la France;’ and Dom Antoine Rivet de la Grange (1683–1749), aided by Duclou, Poncet and Colomb, began that unique ‘Histoire littéraire de la France’ which was completed by the French Institute at the very close of the last century. The Maurists also turned their attention to the history of the French provinces and gathered many valuable collections, the most famous of which was the ‘Histoire générale de Languedoc’ of Doms Vaisètte and Vic (1730–49), recently revised by Molinier. In the latter part of the 18th century the laymen again came to the front, the most notable center of their activity being the Académie des Inscriptions et Belles-lettres, which had been founded by Colbert in 1663. The most valuable product of their labors was the great collection of ‘Ordonnances des rois de France’ by J. de Laurière, Denis Secousse and L. G. de Brequigny (1714–1794). They also continued the ‘Histoire littéraire’ and the ‘Gallia Christiana.’ A further stimulus came when P. C. F. Daunou was appointed national archivist by Napoleon. He brought many foreign archives to Paris and also continued the work on the ‘Histoire littéraire’ and the other great Benedictine collections. The first monumental collection of sources produced in the 19th century was the voluminous ‘Collection de mémoires relatifs à l'histoire de France’ by Petitot and Monmerqué in one hundred and thirty volumes (1819–29). What Germany owes to Stein for the gathering of the sources of German national history, France owes to Guizot, and more, for the latter not only organized the movement for the scientific work in collecting and editing the sources, but also was a historical scholar of the first order who contributed most valuable works from his own pen. Before he left historical writing for the field of political activity he had published a collection of thirty volumes bearing the same title as that of Petitot. In 1834 he organized the Société de l'histoire de France, which was first presided over by Barante and has since included in its membership the most famous historians of France. The ‘Ouvrages publiés’ of this society have amounted to over three hundred and fifty well edited volumes of source material. Even more important was Guizot's initiative in inducing Louis Philippe to appoint a sub-committee of the ministry of public education which was to devote itself to publishing the hitherto unpublished source material of French history. In the next year their work began to appear in the monumental series of the ‘Collection de documents inédits sur l'histoire de France,’ of which about three hundred and thirty volumes have thus far been published. The early editorial associates of Guizot in this enterprise were Mignet, Thièrry, Guérard and Raynouard. With the foundation of the Société de l'Ecole des Chartes in 1829 the provision of competent editors was henceforth assured through the establishment of the world's greatest historical institute for the training of students in the use of documents — L'École des Chartes. The ‘Documents inédits’ are the official French counterpart of the German ‘Monumenta’ and are even more valuable in that they are confined entirely to the presentation of material never before published. The French have also advanced a step beyond any other nation in providing great collections of sources for a study of their history in modern times. This has been due primarily to the fact that no other European state has possessed a national event or movement in modern times at all comparable in picturesque or romantic interest to the French Revolution. Most of the great French collections of sources of modern history relate to some phase of the Revolution. In 1903 the socialist historian and statesman, Jaurès, succeeded in inducing the government to establish a committee of the ministry of public instruction to supervise the publication of the unpublished documents dealing with the economic history of the French Revolution. This work has been carried on by the leading French historians, and the ‘Collection de documents inédits sur l'histoire économique de la Révolution Française’ has been appearing in successive volumes since 1905. The municipal government of Paris has been publishing the ‘Collection de documents relatifs à l'histoire de Paris pendant la Révolution Française’ since 1888. In addition to these public collections, many collections of sources dealing with special phases of the Revolution have been made by enterprising scholars, among whom Aulard and his pupils have been most active.

The French also vied with the Germans in the production of nationalistic historical narrative. The publication of Chateaubriand's ‘Genius of Christianity’ in 1802 gave a lustre and romantic touch to the French past in the middle ages comparable to the effect produced in Germany by Spittler and Johannes Müller. Fauriel anticipated Coulanges and Jullian in his history of Gaul by contending for the superiority of Celtic to Frankish culture in the formation of mediæval civilization. Michaud described the glories of the French in the period of the Crusades. Raynouard drew a vivid picture of the *troubadours* and proclaimed the supremacy of French among the Romance languages. Hanotaux, Fagniez and Chéruel analyzed with both critical erudition and patriotic pride the centralization of the French monarchy by the great statesmen of the 17th century. Lamartine, in a work which rivalled Carlyle in the field of literature and was equally unscientific as history, set forth with fervid admiration the glories of the French Revolution, and especially the exploits of the Girondists. Mignet, the most scholarly French historian in the first half of the 19th century, made an attack on the Bourbon Restoration by representing the French Revolution as the necessary and inevitable outgrowth of the tendencies of the age and as the dawn of a new and better era in the history of the world. Thiers, while critical of the empire, praised the first consul as the saviour of France and of European civilization. Napoleon was defended in his imperial splendor by Masson, Vandal and Lévy; Vandal representing him as peace-loving and goaded to war by English jealousy, and Lévy presenting a superhuman and faultless personality. Thureau-Dangin, while deploring its popular origin, appeared as the historical apologist of the «July Monarchy.» La Gorce dealt with the «Second Empire» as an apologist of monarchy and clericalism, if not of the personality of Napoleon III. Ollivier dwelt with pride upon the liberal tendencies of the last decade of the Empire, and Hanotaux, in one of the finest products of national historiography in France, has described and defended the establishment of the «Third Republic.» Nor was France lacking in general histories written from the national point of view. Early in the 19th century Sismondi produced the first detailed and complete history of France. It was written from the standpoint of an ardent liberal who castigated kings and bishops and lauded the liberal tendencies in the communes. But Sismondi was a Genevan and to some extent a representative of the mild rationalism of Rousseau, and his work was not calculated to arouse intense patriotic enthusiasm. Much different, except in its liberalism, was the brilliant work of Michelet, which was not only a great contribution to French literature but to the stimulation of patriotic pride, especially on the part of liberal Frenchmen. Henri Martin's history of France was less brilliantly written than Michelet's, but rested on sounder scholarship and for a half century has remained the popular national history of France on account of its logical arrangement, lucid presentation and its central theme of the progressive growth of French national unity. The great co-operative work edited by Lavisse belongs to the field of erudite and critical rather than nationalistic historiography. French nationalism was greatly stimulated by the sting of the defeat and injustices of 1870. While the scholarly French historians, such as Gorce and Sorel, maintained an impartiality in treating of the war of 1870, which put to shame the fawning apology of Sybel, there was a great outburst of nationalistic ardor on the part of the «super-patriots» among their countrymen. These tendencies found expression, above all, in the fiery speeches, poetry and pamphlets of Paul Déroulède, the chief of the «Ravanchards,» and in the brilliant polemics and eulogies of his admirer, that ardent Gallican and head of the League of Patriots, Maurice Barrès, whose study of French history has convinced him that «the French make war as a religious duty. They were the first to formulate the idea of a Holy War. It is not in France that wars are entered upon for the sake of spoil, but as a champion in the cause of God, as a knight upholding justice.»

England did not begin any systematic collection of the sources of its national history until the beginning of the 19th century. In the year 1800 the Record Commission was created, but no real historian was connected with its labors until Sir James Mackintosh was appointed in 1825. In 1830 Harris Nicolas called attention to the deplorable condition of the «sources» in England and his criticism led to the creation of a new and more active and critical committee of the Record Commission. A product of this improvement was the edition of the Parliamentary Writs by Palgrave. No systematic activity in the collection of sources began until after the middle of the century. At this time, William Stubbs, the greatest of English mediævalists before Maitland and the Anglicized Russian, Vinogradoff, vigorously criticized the work of the Record Commission. Shortly afterwards, in 1857, Lord Romilly, the Keeper of the Rolls, was able to secure an appropriation from the government to publish the sources of English mediæval history and the general oversight of the project was conferred upon Duffus Hardy, a careful, if not brilliant, scholar. The work of editing these sources has been carried on by a number of English mediævalists, among them Brewer, Gairdner, Canon Robertson, Giles and Dimock, but far the greatest figure was the English Waitz, Bishop William Stubbs (1825–1901). For more than a quarter of a century after 1863 he gave much of his time to this work. This collection, which was finished in 1896 in two hundred and forty-four volumes, is known as the 'Chronicles and Memorials of Great Britain and Ireland during the Middle Ages' ('Rerum Britannicarum medii aevi scriptores) or, more briefly, as the 'Rolls Series' from the fact of its publication by the Master of the Rolls. It is the official British analogue of the 'Monumenta' and the 'Documents inédits.' Less pretentious collections have been provided by the Camden Society and the Early English Texts Society. There should also be mentioned the great collection of the sources of English legal history provided by the Selden Society, and the publication of the manuscript records of important voyages and explorations by the Hakluyt Society.

The historiography of nationalism has not been less vigorous in England than in Germany or France. Its most conspicuous feature has been the expansion of the «Myth Teutonicus» regarding the political superiority of the Anglo-Saxon peoples, which was so popular a tenet of romanticism and had been so fervidly expounded by Edmund Burke. It rested primarily upon the assumption that the Teutonic invaders of England had made a clean sweep of the Briton and Celtic inhabitants and had created a purely Germanic England in culture if not in race. The most vigorous and the earliest statement of this view appeared in Kemble's 'The Saxons in England,' which was published in 1849. It not only taught this notion to Englishmen, but was widely read in Germany and served to furnish the German nationalists with a further basis for their convictions regarding the Germanic "mission," which had been drawn from their own mediæval sources. Freeman carried the argument still further in his 'History of the Norman Conquest,' in which he not only accepted the Saxon theory, but, being an ardent lover of liberty like Michelet, espied the real foundations of political liberty in the Germanic folk-moot, and particularly in its English manifestation. This myth, dating back to Thoyras and Montesquieu, so thoroughly punctured by Coulanges, has been one of the most persistent and pernicious sources of error which have come down from a pre-anthropological stage in historical studies. Even the calm and cautious Bishop Stubbs and the charming John Richard Green were also seduced by this fiction of a Teutonic England, which was to be challenged by Seebohm and modified by Maitland and Vinogradoff. The greatest popular emotional impulse toward this Teutonic interpretation came from the notorious work of the poet-historian, Charles Kingsley, on 'The Roman and the Teuton,' which was first published in 1864. Highly entertaining but almost wholly unscientific and non-historical, it did more to pervert the interpretation of early mediæval history than any other book of its time. He idealized the "young and virile" Teutonic "Forest Children" with the ardor of a Las Casas, and set them in marked and flattering contrast with the morally and physically decadent Romans of the "Dying Empire," and rejoiced in the destruction of the latter by the "Human Deluge" from the North. It is a sufficient commentary upon the accuracy of his work to note that the labors of scholarly mediævalists for the last generation have chiefly centered about the rejection of every one of his main theses. The book, however, gained a great popular vogue and no Englishman could read it without desiring to trace his ancestry back to Arminius and Alaric. Passing from the Middle Ages, where the national grandeur of Britain had been laid by the Teuton, the most intensely nationalistic of English historians, James Anthony Froude, described the glories of the English revolt from Rome. Carlyle lauded the virtues of Cromwell and his associates of the Commonwealth period. The Whig apologists, Mackintosh, Hallam, and above all, Macaulay, described the salvation of the world's liberties by the "Glorious Revolution" of 1688. Macaulay's 'History' is the English counterpart of Treitschke and Michelet, and marks the most brilliant of English contributions to historical literature, as well as a valuable, though prejudiced body of historical knowledge. Lecky's study of 18th century England could scarcely be called nationalistic on account of its impartiality, but Napier praised English prowess in the Peninsular War in a work which was as frank an adulation of war as a process in human society as was Bernhardi's work a half century later. Finally, Seeley, an example of both nationalism and erudition, wrote with restrained pride of the development of the British Empire in his 'Expansion of England' and 'Growth of British Policy.' Not only was Seeley a nationalist, but along with Freeman he was chiefly responsible for turning English historiography into the narrow and unnatural channels of political history. The growth of English national enthusiasm, which accompanied the work of Cecil Rhodes and the Boer War, did not fail to produce its nationalistic literature, which was as far removed from the scholarly grasp of Seeley as was the attitude of Bernhardi from that of Sybel. Bernhardi found his English counterpart in Prof. J. A. Cramb, who detected in England's past wars the governing principle "of that higher power of heroism which transcends reason." Curiously enough, as it had fallen to a renegade Englishman, H. S. Chamberlain, to arrange the apotheosis of "Germania," so it required an American, Homer Lea, to link up the future salvation of the world with the necessity of the universal triumph of "Britannia," through the strengthening and preservation of "the scarlet circle of power that the Saxon has marked around the earth as has no other race before him."

Italy shares the double honor of having been the first nation to provide a complete collection of its sources of national history and of having produced the most indefatigable of all editors in Lodovico Antonio Muratori (1672–1750). From 1723 until his death in 1750 he brought together in the 25 folio volumes of the 'Rerum italicarum scriptores' nearly all of the extant sources of Italian history. So thorough was his work that it has only been deemed necessary in recent years to undertake a new edition of his collection, which has been in progress since 1900 under the supervision of Giosuè Carducci and Vitorio Fiorini. It is scarcely to be doubted that the new edition is quite as much a sublimation of patriotic impulses as an enterprise entered upon in the interests of historical scholarship.

While the national narrative history, like the collection of sources, dates back to a more remote period in Italy than in the other states of Europe, it began in its modern phase with Botta's 'History of Italy during the Revolutionary and Napoleonic Wars,' which breathed forth the ardent liberalism which found expression in the politics of the period in the activities of the Carbonari. Coletta condemned the corruption and incapacity of Bourbon absolutism in Naples. Troya and Tosti surveyed the history of mediæval Italy for evidence to support their plea for papal leadership in Italian unity, while D'Azeglio turned to contemporary Italy to prove papal incapacity and to call attention to the promise of leadership in the House of Savoy. More recently Luzio, De-Cæsare and Chiala have dealt with the period of the "Risorgimento" and establishment of national unity, but the Italian enthusiasm over their attainment of national independence and unity has scarcely cooled sufficiently to find history an effective method of expression; up to the present time it has been recounted chiefly in the patriotic poetry of Giosué Carducci and Gabriele D'Annunzio.

The first collection of Spanish sources was not the work of Spaniards, but of the itinerant English scholar, Robert Beal (d. 1601), who published his 'Rerum hispanicarum scriptores' in 1579–81. Nearly two centuries later J. A. C. Bertodano produced his extensive collection of sources on diplomatic history (1740–52). The great national collection of sources, however, was not begun until the middle of the 19th century when Pidal, Salvá and others started the 'Coleccion de documentos inéditos para la historia de Espagña,' which was completed in 112 volumes (1842–95). In addition, the Royal Academy of History at Madrid has been publishing source material since 1851 in the collection entitled 'Memorial histórica español.' Spain found her great national historian in Modesto Lafuente (1806–66). His monumental 'Historia general de España,' which was intended to be a continuation of Mariana, appeared in 30 volumes from 1850–67, and was continued after his death by J. Valera.

The sources of Austrian history were not only collected in the German 'Monumenta,' where the great scholar, Theodor Sickel, rendered valuable editorial assistance, but also in separate national collections, the 'Fontes rerum Austriacarum,' published since 1849 by the Vienna Academy, and the new edition of Böhmer's 'Regesta imperii,' edited by Ficker since 1877 at Innsbruck. The great national narrative history of Austria was Arneth's monumental work on the times of Maria Theresa, while Klopp has recalled the imperial heroes of the Thirty Years' War and conducted an attack on Frederick the Great.

In Bohemia, Czech nationalism did not initiate interest in history as in other European states, but rather history aroused nationalism in the first instance. To the vigorous patriotism of F. Palacky's 'History of Bohemia,' more than to any other source, the modern Czech national spirit owes its origin. The sources of Bohemian history have been collected by the greatest of Bohemian historical scholars, Anton Gindley, and are entitled 'Monumenta Historiæ Bohemica' (1864–90). The Hungarian government has been publishing the 'Monumenta Hungariæ historica' at Budapest since 1857, and Hungary has found in Fessler and his continuators its national historians. Poland has published two large collections of sources, and Lelewel and Szajnocha have reminded the Poles of their ancient splendor and power. The obscurantism of Czardom has prevented the development of historical scholarship in Russia, a loss to Russia which can be appreciated by a survey of the great work of the exile, Vinogradoff. Karamsin's antiquated history presents an apology for the absolutism and Oriental culture of the early czars, while the more recent and scholarly work of Soloviev defends the introduction of Western culture by Peter the Great. Further, it should not be forgotten that both Belgium and Holland are represented by extensive collections of sources and able national historians. Belgian enthusiasm for the collection of sources of national history began with the attainment of independence in 1830. The great national collection is the 'Collection de chroniques Belges inédites,' published in 111 volumes at Brussels since 1836. The 'Society d'émulation de Bruges,' published between 1839 and 1864 the 56 volumes of the 'Recueil de chroniques, chartes, et autres documents concernant l'histoire et les antiquites de la Flandre occidentale.' In addition Wauters has edited the great collection of communal charters and Gachard has edited the foreign archives of the period since the 15th century. The great Catholic and Belgian counter-blast to Motley's work, as well as to that of Prinsterer, was contained in the work of Lettenhove on the 16th century. He condemned William the Silent and his Protestant supporters and defended the position of Spain and the Catholic party. His somewhat chauvinistic and obscurantic work has been superseded by the admirable critical works of Frédéricq and Pirenne. While Holland has not provided as complete a collection of national sources as Belgium, the Historical Society of Utrecht has been publishing important sources since 1863 — the 'Werken uitgegeven door het Historisch Genootschap te Utrecht' — and Prinsterer has edited the voluminous archives of the House of Orange. In 1902 a royal commission of the most eminent Dutch historians was appointed to arrange for the systematic publication of the manuscript sources of the history of Holland. The most enthusiastic Dutch nationalistic narrative history was that by Prinsterer in which Protestantism and the House of Orange received their vindication and eulogy. This has now been rendered obsolete by the scholarly monographs of Fruin, the greatest of Dutch historians, and by the accurate and well-balanced general history of Blok. The Scandinavian nations have not been unproductive in the field of national historiography. The sources have been collected in the following series: the 'Scriptores rerum Danicarum medii ævi,' edited by Langebek and his successors; the 'Diplomatarium Norvegicum,' edited by Lange; and the 'Scriptores rerum Suecicarum,' edited by Geijer and his associates. The nationalistic historical narrative was introduced in Denmark by Worsaae; in Norway by Keyser and Munch; and in Sweden by Geijer, Carlson and Fryxell. These works have been succeeded by the more recent and scholarly national histories of Steenstrup on Denmark; Sars on Norway; and Hjärne on Sweden. If there were available space it would be easy to demonstrate the very great, if not determining, influence of the study of the glories of their national past upon the rise of the national aspirations of the Balkan peoples since 1820. The well-known influence of Alexandru Xénopol's 'Histoire des Roumains de la Dacie Trajane' upon Roumanian nationalism is but a typical illustration of the fertility of such an investigation.

Surely, no account of the interrelation of nationality and historiography in modern times would be complete without some reference to the national historiography of Judaism and Zionism. The rise of Jewish nationalism in the last century was intimately related to the general development of nationality in Europe during that period. This stimulated Jewish national spirit, both by the direct influence of imitation and through the persecution of the

Jews, as a result of the growing chauvinism throughout continental Europe after 1870. The relation of this growth of Jewish national sentiment to the remarkable development of the interest of the Jews in their national history is readily apparent. Historical societies were formed in all the leading modern states — the «Société des études juives,» founded in 1880; the Historical Commission of the «Union of German-Jewish Congregations,» appointed in 1885; «The American Jewish Historical Society,» created in 1892; and «The English Jewish Historical Society,» founded in 1895. These societies have done valuable work in compiling sources of Jewish history and in arousing interest in its study. Especially to be noted is the 'Regesten zur Geschichte der Juden im fränkischen und deutschen Reiche bis zum Jahre 1273,' published by the German Jewish Historical Commission since 1887. Including an account of the Jewish persecutions in the mediæval period, it has tended to arouse their national resentment at past, as well as present, oppression. The Jews have also been stirred by the work of a great national historian, Heinrich Graetz (1817–91). Isaac M. Jost (1793–1860), in his 'History of the Israelites,' and his 'History of Judaism,' had surveyed the history of the Jews, but he was too liberal, rationalistic and impartial a writer to serve as a truly national historian. Widely different was the work of Graetz, sometimes called the Jewish Treitschke. Conservative and generally orthodox, and fired with a warm enthusiasm for the past and future of his people, Graetz traced in an eloquent manner the history of the Jews from their origins to 1848, laying special stress upon their literary and spiritual development, in other words, upon the elements which contributed the most to the development and persistence of their national culture. Graetz's work was especially in line with the development of «Zionism,» for he insisted that the true Messiah was the national spirit of the Jewish people and he discouraged further delay through awaiting the coming of a personal Messiah. In addition to the general history of Graetz, there should be mentioned the many histories dealing in a comprehensive fashion with the history of the Jews in the different European states.

In connection with this brief summary of the reaction of nationalism upon historiography in Europe some passing reference should be made to the growth and accumulation of archival material and its accessibility to students. The development of the national states and their administrative bureaucracies led to a great amount of administrative «red tape» and to the growth of fixed diplomatic correspondence. From these sources a rich storehouse of historical material had accumulated in the national, ecclesiastical and private archives by 1800. Before they could be generally useful to historians, however, the sources in the archives had to be classified and centralized and made public to creditable historians. In the matter of centralization and classification of archival material France has taken the lead, due chiefly to the large number of highly-trained archivists provided by L'École des Chartes. At the present time only England is exceedingly backward among the European states in providing for a systematic arrangement and classification of its archival material. In the same way that national pride and competition led to the compilation of the great source collections of national history, it forced the several European states at various dates during the 19th century to open the national archives to historical scholars. In addition, the liberal-minded Pope, Leo XIII, opened the Vatican archives in 1881 and secular scholars for the first time had the privilege of examining the treasures that Baronius had made use of. Even at the present time, however, complete freedom is not accorded anywhere in the use of archival material, scholars being excluded from the more recent documents. For instance, the Vatican archives are accessible only to 1815, those of France to 1830, and those of England to 1867. In America, scholars like Gaillard Hunt are laboring to put the archival material of the United States upon the same high plane that it has reached in most European countries.

The United States has never provided a great official collection of the sources of its national history comparable to those prepared by the European countries. This has been due in part to the particularism inherent in the American Federal system and in part to the fact that the American central government has been too much absorbed in the details of routine legislation to be able to concentrate its attention on the furthering of intellectual interests. The true American counterpart of the movement of collecting sources of national history, which was associated in Europe with the names of Pertz, Guizot, Nicolas, Hardy and Stubbs, is to be found in the rather pathetic attempt of Peter Force (1790–1868) to obtain adequate government support for his «American Archives,» which were designed to constitute a complete collection of the sources of the history of the United States from the period of discovery to the formation of the constitution. Its psychological and historical affinity with the European movement is clearly indicated by Force's statement of his aims. «The undertaking in which we have embarked is, emphatically, a national one; national in its scope and object, its end and aim.» After a painful process of protracted importuning, Force received a Federal appropriation which allowed him to begin publishing his «Archives» in 1837, but the government aid was soon withdrawn and the published material was but an insignificant fraction of what it had been planned to include. Owing to the fact that American historical scholarship was then a generation behind that of Europe, Force was primarily a hard-working antiquarian compiler rather than a scholarly editor like Pertz, Waitz, Mignet, Guérard, Hardy or Stubbs, and the national loss from the cessation of his work was infinitely less than would have been occasioned by a discontinuance of the «Rolls Series,» the «Monumenta» or the «Documents Inédits.» The collections which have been made have been primarily the result of the enterprise of individuals, publishing companies and the historical societies of the several commonwealths. The process began with the publication of Jared Sparks' writings of Washington between 1834 and 1838. The most ambitious attempt to make a thorough collection was the work of Mr. Hubert Howe Bancroft in the last half of the 19th century, in his gathering of the sources of the history of the Pacific States. Unfortunately, he did not follow the example of Stein and secure the aid of a Pertz, but trusted to his own untrained guidance the execution of the project, with the result that the work lacked in critical scholarship and careful editing. An incomparably more scholarly work was the co-operative history of the colonization of America, edited by Justin Winsor, but, though this contained much source material, it was primarily a narrative work giving a critical review of the sources rather than including them. Parallel with this movement went the publication of source material by the various commonwealths in the vast collections of colonial records and archives, but in the great majority of cases these collections were prepared by erudite antiquarians rather than by men trained as critical historical editors, and there was no uniformity in the methods employed. Some of these state collections have, however, been of a very high order, the most notable being, perhaps, the extensive series dealing with the exploration and settlement of the middle West by Reuben G. Thwaites of Wisconsin. Another mode of collecting sources was exhibited in the editions of the messages and papers of the presidents and the writings of the chief statesmen by numerous scholars, which have varied widely in quality, reaching the highest level in W. C. Ford's 'Writings of Washington'; Gaillard Hunt's 'Writings of James Madison' and P. L. Ford's 'Writings of Jefferson.' The United States has not been lacking in editorial ability of the highest order, for in Worthington C. Ford, James Franklin Jameson, Paul Leicester Ford and Gaillard Hunt are to be found the equals of Pertz, Waitz, Guizot or Stubbs. The great defect has been the lack of concerted planning and continued and adequte government aid. Promising beginnings in the right direction are to be seen in W. C. Ford's edition of the 'Journals of the Continental Congress' and the scholarly products of the Carnegie Institution under Dr. Jameson's direction. John Bassett Moore has labored with almost Benedictine patience and productivity in the preparation of his monumental series dealing with the documentary history of diplomacy. There also should be mentioned the monumental collection of sources dealing with the history of labor in America which has been prepared by Professor Commons and his associates. Miss Adelaide Hasse has begun an invaluable series of volumes describing and classifying the sources for American economic and social history which are available in the public documents of the various commonwealths. On the whole, however, the United States has been incomparably delinquent in the thorough and scholarly collection of the sources of its national history, and it cannot seek refuge behind any assertion that this has been due to a lack of rabid nationalistic emotions.

If this country has not kept abreast of European development in the editorial aspect of national historiography, it can lay claim to having produced historians enthused with as ardent a patriotism as fired a Treitschke, a Michelet or a Froude. Nationalism in American historiography has, naturally, centred mainly about the romantic period of colonization and the struggle for American independence, and American historians have surrounded this period with the halo given to the early national history of Germany and France by Johannes Müller and Chateaubriand. The chief figure in the creation of this national epic of migration and deliverance was George Bancroft, whose early years fell in that period of national bumptiousness and florid democracy in the «thirties» and «forties.» To Bancroft, the history of the formation of the American Republic was no modest secular achievement of ordinary mortals, but a veritable Æneid in which Augustus was replaced by Washington and which exhibited in its succession of scenes «the movement of the divine power which gives unity to the universe, and order and connection to events.» His history of the United States through the period of the Federal Constitutional Convention represented the process of colonization as the flight of brave spirits from oppression, characterized the American Revolution as a crusade of wholly virtuous and disinterested patriots in behalf of the liberties of civilized humanity, described the American constitution as the creation of a group of unique mental giants, never before equalled and not to be matched at any later epoch, and regarded their work as even more notable than its makers. The pathetic inaccuracy of all of his major premises can only be appreciated by a careful perusal of the scholarly treatment of the same topics by Beer, Van Tyne, M. C. Tyler, Osgood, Alvord, Andrews, Fisher, Farrand and Beard, and the damage done to proper perspective in American history by his works has been almost incalculable and irreparable. The myth was perpetuated in Palfrey's long Puritan apology and was repeated in a less vigorous form in Mr. Lodge's discussion of the English colonies in America. From his pride in American exploits in behalf of liberty and democracy, Motley was encouraged to study the analogous movement among the Dutch, when they rebelled against Spanish tyranny and established a republic. Francis Parkman, turning from the Anglo-Saxon phobia of Bancroft, first gave full credit to the work of France in colonizing the New World. He found that the record of heroism had not been wholly monopolized by the English and German colonists. While Parkman had turned his attention to the French in the North and West, William H. Prescott found his theme in the conquest and colonization of Central and South America by the Spanish, and in a brilliant description of the splendor of the native American civilizations of Mexico and Peru. Mahan, enthused by the exploits of the small American navy in the wars of the Revolution and 1812, was encouraged to make a study of the influence of naval supremacy upon the history of the past. Few works have been more influential in stimulating the disastrous growth of modern armaments. The period of cementing the national union through the efforts of the Federalists was glorified in the works of Hildreth and John Church Hamilton, and the blessings of the «pure» democracy of the Jacksonian epoch were set forth in the essays and addresses of Bancroft, who believed that he detected the very «voice of God» in the acclaim of Jackson's followers. Roosevelt described the process of American expansion westward with the buoyant and ill-concealed pride of an admirer of the

West and an ardent patriot and national imperialist. Von Holst beheld in the struggle over slavery one more great episode in that eternal conflict between righteousness and iniquity. Professor Burgess saw in the success of the North in the Civil War, not only a justification of his own nationalistic political philosophy, but also a sure manifestation of Teutonic genius in the field of political unification and organization. On the whole, however, by the time that the achievements of the Civil War and Reconstruction periods had come to be subjects for historical analysis the objective scholarship of the critical and erudite school had begun to prevail and the «American epic» passed, to be preserved only in the school texts of succeeding generations. The task of rationalizing the «Bancroftian epic» and adapting it to the prevailing tendencies of the latter part of the 19th century fell to the philosopher-historian, John Fiske (1842–1901). By his amiable Spencerian rationalism and his eulogy of the rise of the middle class he best summed up the prevailing spirit of the educated Americans of his time, and by his lively and attractive style and his primary concern with the period of discovery, colonization and revolution he attracted a following which probably entitled him to the position of the popular national historian of the last generation. He was the prophet of the new era in the interpretation of Anglo-American relations which replaced the Puritan and American epic of Bancroft by an account of the rise and triumph of the middle class in both England and America — «an epic of the English-speaking Peoples.» He was as fully convinced as Burgess of the supreme political capacity of the Teutonic branch of the «Aryans.» He held that the first instance of self-government in recorded history was to be seen in the Teutonic village-community, which was an «inheritance from pre-historic Aryan antiquity,» and he believed that «American history descends in unbroken continuity from the days when stout Arminius in the forests of northern Germany successfully defied the might of imperial Rome.» Fiske, however, stressed the element of liberty as the surest criterion of political capacity rather than the aspect of order and authority which found favor with Burgess. England under Gladstone seemed far better adapted than Germany under Bismarck for furnishing an edifying example of the attainment of complete political liberty, and the then popular theory of a wholly Teutonic England was an ethnic argument in favor of such an undertaking. Therefore, instead of conducting the muse of liberty directly from the «German forest primeval» to the Federal Constitutional Convention of 1787, Fiske arranged a detour in her migration to the new world which would guide her to America by the way of the «Glorious Revolution of 1688,» in which, as the work of the English «bourgeoisie,» «freedom both political and religious was established on so firm a foundation as never again to be shaken, never again with impunity to be threatened, so long as the language of Locke and Milton and Sydney shall remain a living speech on the lips of men.» Working hand in hand with George Otto Trevelyan, he tried to show how the American Revolution was but the perfect fulfilment of the spirit of 1688. He pictured it as the work of Whigs on both sides of the Atlantic in the heroic effort to check and crush the autocratic tendencies of a Tory squirearchy and the unconstitutional tryanny of a «German King,» and to preserve for the world the liberties embodied in the Bill of Rights. He dwelt with pride upon the establishment of the American Federal Republic and regarded it as the great contribution of the Western Hemisphere to the solution of political problems, by reconciling the liberty of the New England town-meeting with the existence of large political aggregates. He contemplated with unmixed pleasure the progress of the middle class in its political and economic conquest of the American continent in the 19th century, and, just before his death at the opening of the 20th, he was deeply gratified to see his own country at last assume its part of the «white man's burden» by the retention of the Philippines. Not at all a militarist, he looked upon this as a most significant step in that process of bringing the world under the peaceful dominion of «the two great branches of the English race which have the mission of establishing throughout the larger part of the earth a higher civilization and a more permanent political order than any that has gone before.»

Even the more progressive Latin American states have begun to produce extensive collections of the sources of their national history. The 'Documentos para la Historia Argentina,' which have been edited by L. M. Torres and the faculty of philosophy and letters of the National University of Buenos Aires since 1911, is a typical example of this process.

The net result of the growth of nationality and of nationalism upon historiography has been greatly varied and a mixed blessing. Its fortunate results have been, above all, the provision of great collections of source material which would otherwise never have been made available and the training of many excellent historians in the process of the compilation and editing of the sources. The deplorable effects have centered about the creation of a dangerous bias of patriotism, which not only prevented a calm, objective and accurate handling of historical facts, even by highly trained historians, but also contributed in no small degree to the great increase in chauvinism which led to the calamity of 1914. The responsibility of the nationalistic historians in this regard has been well stated by Prof. H. Morse Stephens, probably the most thorough student of this particular subject: «Woe unto us! professional historians, professional historical students, professional teachers of history, if we cannot see written in blood, in the dying civilization of Europe, the dreadful result of exaggerated nationalism as set forth in the patriotic histories of some of the most eloquent historians of the 19th century.» It would be fortunate, indeed, if this were all, but for every patriot made by a Treitschke, a Michelet, a Froude or a Bancroft, hundreds have been enthused by the petty chauvinism of the third-rate textbook compilers who have imitated their bias without their literary virtues. The nature and effect of these textbooks upon the past generation has been indicated for this country by Mr. Charles Altschul and for France and Germany by Dr. J. F. Scott. England has not fallen behind any of these nations in this respect. Some optimism for the future may, however, be discovered in the fact that there is an ever greater tendency for the textbook writing to be handed over to reliable and relatively unbiased professional historians.

It should be pointed out in passing that the zeal for collecting historial source material was not limited to the sources of secular history. In the same way that the gathering of the sources of national history was begun by Duchesne in the 17th century, so activity in collecting the sources of ecclesiastical history was initiated at this same period and has been continued to the present time. The first complete collection of the writings of the Church Fathers was gathered and published by Migne in 382 volumes between 1844 and 1864. While, like Bancroft's 'History of the Pacific States,' it was a publisher's rather than a scholar's enterprise, it has been of immense value to students. The failure of Migne to use the best texts in all cases has led to the attempt to produce better collections of Patristic literature. Since 1866 the Vienna Academy has been publishing a carefully edited collection of the writings of the Latin Fathers, and in 1897 the Berlin Academy began to issue an edition of the Greek Fathers. The collection of material dealing with the lives and deeds of the saints, which was begun by Bolland in the middle of the 17th century, is still in progress. A collection of the acts of the Church councils by Labbe and Cossart appeared in the latter half of the 17th century and was continued by Etienne Baluze in 1683. In 1685 Jean Hardouin started a new collection, and in the middle of the 18th century Mansi compiled the largest of all collections of the councils, a new edition of which is now appearing in Paris. At the same time that Mansi was preparing his collection of conciliar material Mainardi published the collection of papal bulls. In the latter half of the 19th century Jaffé and Potthast produced scholarly collections of papal "Regesta" to the year 1304, and Kehr is now engaged in the publication of the latest and most complete compilation of this type of material. On the whole, the collections of source material for the history of the Church are fully equal if not superior to those for the secular history of Europe.

5. The Rise of Modern Critical Historical Scholarship.—Professor Gooch, in his scholarly and informing account of the development of historiography in the 19th century, points out that prior to the beginning of the last century historical science labored under four serious handicaps — the catastrophic theory of historical causation and the contempt for the mediæval period, which had characterized the rationalist school; the absence of any extensive collection of original sources; the lack of critical methods in handling historical materials; and the failure to provide for any systematic and competent teaching of the subject-matter or methods of history. It has already been pointed out how the "Romanticists" had corrected the faults of the rationalists by insisting upon the law of continuity in historical development and by looking upon the mediæval period as the most fruitful age for historical research, and it has also been briefly shown how the pride of exuberant nationalism had led to the provision of magnificent collections of source material for the history of every leading modern nation. It now remains to trace the rise of critical scholarship in the field of history and to show how critical methods were widely disseminated through the development of the professional teacher of history.

It was shown above that the promising rise of critical methods in the use of historical materials as an incident of humanism and exemplified in the work of Blondus, Beatus Rhenanus, Vadianus and Zurita had been checked and smothered in the fierce religious controversies of the period of the Reformation. By the latter part of the 17th century, however, the volume of polemic had tended to decline and it was again possible to assume to some extent an objective attitude and to begin a dispassionate search for truth. This development of scientific historical method passed through two natural and normal stages: first, the development of those auxiliary sciences, such as diplomatic, chronology, palæography, epigraphy and lexicography, which would enable the historian to ascertain the genuineness of a document; and, second, the growth of internal or interpretative criticism, which passes beyond the mere establishment of the authenticity of the document and examines into the degree of the credibility of its author.

The first of the above steps in the growth of modern historical science was primarily the work of those same Benedictine monks of the Congregation of Saint Maur who had been so active in the preliminary period of the collection of the sources of French history. Their priority in this movement seems to have been due to the fact that not being a militant order they did not have to appear as vigorous apologists for Catholicism and that they also had the advantage over lay writers in not being compelled to glorify a particular city, province, family or dynasty. In the quiet libraries of their monastery they brought into existence an indispensable portion of the mechanism of the modern historian. The leader of the historical scholars of the Order was Jean Mabillon (1632–1707), who created the science of diplomatic — or the critical method of determining the authenticity of documents. In 1675 a Jesuit historian, Papebroch, made a sweeping claim that many of the documents upon which the Maurists had relied were worthless. Mabillon devoted the next six years to the preparation of his reply, and in 1681 his opponent was crushed under the erudition of the 'De re diplomatica,' which remained the standard treatise on the subject until it was displaced in the present generation by the volumes of Sickel, Ficher and Giry. The basis of modern paleography and archæology was laid by Dom Bernard Montfaucon (1655–1741) in his 'Palæographia græca' and his 'L'Antiquité expliquée et représentée en figures.' While a layman, Charles du Fresne Du Cange had founded historical lexicography in his 'Glossarium mediæ et infimæ latinitatis' (1678), the Benedictines left their impress upon this field in the famous revision of Du Cange's work by Dom Carpentier (1768). Finally, in a great co-operative work, begun by Dantine and Durand, and finished in 1790 by Dom Clément, 'L'Art de vérifier les dates,' chronology was at last taken from the hands of Eusebius and Jerome and put on a scientific foundation. Of course, the Benedictines did not limit their efforts wholly to the perfecting of methods of research, but applied these methods in the production of voluminous works and source collections on Church and national history. The advance in scientific method which they brought into existence can scarcely be overestimated. Before this time there had either been no attempt to cite sources or the citations had been hopelessly confused; there had been no general practice of establishing the genuineness of a text; and there had been no hesitancy in altering the text of a document to improve the style. Now documents were searchingly examined as to their authenticity, the text was quoted with exactness, and the citations were invariably included and given with scrupulous accuracy. It is, however, easily possible to overestimate the modernity of the Maurists; they were as near to Timæus as to Ranke or Gardiner. Their critical methods were almost entirely limited to external or textual criticism — to an examination of the genuineness of the document. They were greatly inferior to the school of Voltaire in examining the credibility of contemporary authorities and generally regarded the contents of an authentic primary source as entirely identical with absolute truth. Neither did they possess anything of the romanticist conception of historical development and the continutiy and organic nature of cultural evolution. They were nearer to scientific antiquarians than to modern historians. Nor were they sceptical of ecclesiastical tradition. They labored under the pious opinion that the truth would substantiate the contentions of the Church, but in reality provided their rationalist contemporaries and successors with a supply of scholarly information with which to rout the ecclesiastics.

Almost identical in method with the Benedictines was the work of the Jansenist, Louis Sebastian de Tillemont (1637–1698), on the history of the Church and the Roman Empire to 600 A.D. His product was highly objective, being primarily a mosaic pieced together from sources which were selected to harmonize but were not altered. It was one of the earliest of modern historical works to include a critical discussion of the principal sources for each period. His solid work, designed as a pillar of Christian doctrine, was one of the chief sources used by the sceptical Gibbon. A similar example of the new erudite methods was the researches into the history of the Guelfs carried on by the German philosopher, Gottfried Wilhelm Leibnitz (1646–1716) in his 'Annals of the House of Brunswick.' A step was taken towards the development of internal criticism by the great Italian, Muratori (1672–1750), who made a number of advances over his master, Mabillon. He was as critical of miracles as Blondus and departed widely from the Benedictine practice of regarding contemporary sources as infallible. The methods of Mabillon and Muratori were combined with some faint anticipation of the romanticist conception of historical development in Rapin Thoyras' (1661–1735) 'History of England,' which long remained the chief source on the Continent for the history of 17th century England. Finally, in the co-operative 'Universal History' produced by the English scholars, Campbell, Sale, Swinton, Bower and Psalmanazar, the erudite school published the most scholarly universal history since the humanist attempt in the 'Enneades' of Sabellicus. While thoroughly pious in its approach, it has been called by no less authoritative a critic than Fueter "the first universal history worthy of the name."

While Vadianus, Muratori and Thoyras had shown at least an embryonic power of criticizing the credibility of contemporary or "primary," sources and documents, the real beginning of the searching internal criticism of historical documents must be assigned to the work of the Jesuits. Having been put upon the defensive by the Protestant onslaughts, they were compelled to examine the sources of ecclesiastical history to discover what portion of the old traditions and legends would bear the test of scientific scrutiny. By this means they hoped to eliminate the damaging criticism of the Church by Protestant historians who ridiculed the many crude and obviously false legends connected with the Catholic past. The chief example of this Jesuit criticism was the monumental 'Acta Sanctorum,' begun by the Belgian Jesuits under Bolland's direction in 1643. Here the sources bearing on the lives of the various saints were arranged according to their age and authenticity. A much more healthy spirit of criticism was exhibited by Pierre Bayle (1647–1706) in his 'Historical and Critical Dictionary' and in his criticism of the history of Calvinism by Maimbourg. Bayle took especial delight in pointing out the grave discrepancies between the views and opinions of contemporary authorities and did not hesitate to extend his methods to the examination of "sacred" history. Since the period of humanism the historians of classical antiquity had been regarded with a reverent confidence second only to the "Fathers." Valla had questioned some assertions of Livy, but it was left for Louis de Beaufort (d. 1795) in his 'Dissertation sur l'incertitude des cinq premiers siècles de l'histoire romainç,' to prove that the divergence in the accounts of the period by the great classical authorities indicated that the history of Rome before the third century B.C. rested almost wholly on legendary material. The work of Beaufort marked a break with humanism in attitude and method as well as in style. The most obscure member of this critical school, but perhaps the ablest historian before Niebuhr was Jean Baptiste Dubos (1672–1740). His 'Histoire critique de l'éstablissement de la monarchie francaise dans les Gaules' was the first attempt to turn the new critical methods upon the study of institutions. In as objective a spirit as that exhibited by Ranke he examined the documentary sources for the early history of France and anticipated Fauriel and Coulanges in proving that the Merovingians had merely adapted and not displaced Roman culture in Gaul. He also anticipated the romanticists in possessing a grasp upon the conception of the gradual and organic development of civilization which was vastly superior to the catastrophic theory of the contemporary rationalists. In this respect he marked an advance in the direction of Möser. Less critical, but more truly historical was the 'History of Osnabrück' by Justus Möser (1720–94), regarded by many as the first real constitutional history, in that it showed the manner in which political institutions develop out of the deeper social and economic forces in the life of a state. It was a disciple of Möser, Barthold Georges Niebuhr (1776–1831), who is conventionally regarded as the creator of modern historiography, but if the foregoing discussions have shown anything they have proved that no single personality or school can be regarded as having brought into existence the totality of modern historical science. Niebuhr, a Dane called to the new University of Berlin bv Humboldt in 1810, is one of the best examples of this tendency to synthesize the progressive methods of his predecessors. He was influenced by Savigny's romanticism in the study of the evolution of legal and political institutions. He followed Möser in his profound conception of the development of political institutions. Finally, he applied to the sources of early Roman history the critical methods which had been adopted by Wolf in his epoch-making studies of the authorship of the Homeric poems. His 'Roman History' was the first book to combine the best of the newer critical methods with the constructive principles of synthetic institutional history, and it was the chief source of inspiration for the historical work of his greater successors, Leopold von Ranke and Theodor Mommsen.

Von Ranke (1795–1886) first became interested in history through his studies in classical literature, the influence of romanticism and the reading of Niebuhr. His immediate activity as a historian was initiated by his discovery of the wide divergence between the accounts of the events of the 15th century in Italian history as presented by the leading contemporary authorities. This led to the publication in 1824 of his 'History of the Romance and Germanic Peoples, 1494–1535.' Its most significant portion was the appendix, entitled 'Zur Kritik neuerer Geschichtschreiber,' and devoted to an analysis of the sources of information for the period that he had covered. This did for internal and interpretative criticism what Mabillon's treatise on diplomatic had done for external criticism, or the critical study of texts, It was Ranke's great contribution to historical method to have insisted that the historian must not only use strictly contemporary sources of information, but must also make a thorough study of the personality, «tendencies» and activities of the author to determine as far as possible the personal equation in his record of events. There were two more fundamental characteristics in the historical mechanism of Ranke, namely, the conception derived from the romanticists that every nation and age is dominated by a prevalent set of ideas, designated by Ranke, the «Zeitgeist,» and the doctrine that the historian must view the past wholly freed from the prejudices of the present and must narrate the events of the past «wie es eigentlich gewesen.» His defects have been pointed out by later writers as the failure to exhaust the sources available for any subject upon which he wrote and a primary concern with political events and dominating personalities to the neglect of the more fundamental facts of economic and social, and even of political, life. While he ranged over the entire history of Europe and the world and left an enduring mark upon every field, it was his contributions to historical methods and teaching which were mainly significant for the growth of historiography. To historical method he contributed primarily through his formulation of the principles of internal criticism and his insistence upon entire objectivity in the treatment of the past. His influence upon historical scholarship through his teaching was probably greater than through the exemplification of his methods in his written works. That fundamental instrument for the advancement of historical scholarship in the academic world — the Historical Seminar — was founded by Ranke in 1833 and it served to train not only the leading German historians, but historical students from all over the world who came to serve in the historical laboratory which he maintained during the period of half a century. When Ranke became too aged to conduct his seminar with effectiveness, his greatest pupil, George Waitz, adopted the methods of his master at the University of Göttingen, where nearly every leading mediævalist of the last generation received at least a part of his training.

With the work of Ranke the foundations of modern historical scholarship were finally laid. The progress since his time has consisted primarily in a further refinement of critical methods and their general dissemination among a continually growing body of historical scholars. This progressive expansion of scientific historical scholarship has been in part the result of the direct imitation of Ranke's methods by his students and in part the outgrowth in every country of those same preliminary conditions and developments which made the work of Ranke possible.

In Germany the growth of the critical school of historiography was primarily the result of the work of Ranke. Among his pupils were Köpke, Jaffé, Waitz, Giesebrecht and Von Sybel who perpetuated the methods of their master in their own writings and teaching. Waitz probably surpassed Ranke in the thoroughness and exactness of his scholarship. The existence of independent sources of the new scholarship is best seen in the case of Mommsen, who was a product of the same general circumstances that made the work of Ranke possible, and who fully equalled Ranke in the field of scholarship. In the generation since Droysen, Treitschke and Sybel, the works of the younger contributors to German history have shown more perfectly the objectivity of Ranke and have eliminated the errors due to the rabid patriotism of their predecessors. Moriz Ritter has produced the most detailed and scholarly treatment of the Thirty Years' War and the events of the Counter-Reformation. Bernhard Erdmannsdörffer has dealt with great scholarship and candor with the period from the Thirtv Years' War to the accession of Frederick the Great and has rejected Droysen's laudatory picture of the early Hohenzollerns and their «mission.» R. Koser, in what is probably the most scholarly biographical product of modern critical historiography, has removed from Frederick the Great the halo with which he was adorned by Droysen and Carlyle. The period from Jena to the Revolution of 1848 has been studied by Hans Delbrück, Max Lehmann and F. Meinecke with much greater fairness, poise and scholarship than was exhibited by Treitschke. Erich Marcks and Max Lenz have removed from Bismarck the «Sunday clothes» with which he was dressed by Sybel and have laid bare his policies and intrigues. Alfred Stern is engaged upon what is by far the most exhaustive and scholarly history of Europe in the 19th century. Further, the influence of the École des Chartes in improving the exact methods of handling documents has been evident in the Germanies in the work of such men as Sickel and the foundation of the Vienna Historical Institute in 1854. The general nature of German historical scholarship as exemplified in the adoption of critical methods is best observable in the co-operative work edited by W. Oncken, 'Allgemeine Geschichte in Einzeldarstellungen'; and in the 'Jahrbücher der deutschen Geschichte,' which has been in process of publication by the Historical Commission of the Munich Academy since 1862. The most erudite and complete synthesis of scientific historical methodology ever prepared has been produced by E. Bernheim, though G. Wolf has more recently made a creditable contribution to this field. The discussion of the application of this new critical scholarship to the field of German political history should not cause one to lose sight of the fact that equal progress has been made in the field of Church history since the days of the Centurians. Interest in this subject was revived by Neander in the first half of the 19th century. In the work of Hinschius, Richter and Sohm on the canon law; Hauck's history of the German Church; the labors of Hefele and Hergenröther on the councils; Pastor's history of the Popes of the "Renaissance"; Harnack's monumental history of Christian dogma, and Kraus' history of Christian art, are to be seen works which rank with the best products of critical political historiography.

The growth of critical historical scholarship in France owed something to German influences and some of the leading French historians, such as Monod, were trained by the German masters, but on the whole the progress of historical scholarship in France has been primarily an indigenous development. To Niebuhr might be compared Fauriel, who was the inspiration of Guizot and his associates. While Guizot never equalled Ranke with respect to exact scholarship or productivity he was far superior to Ranke in analysis and more capable and active as an editor, and his influence in stimulating historical scholarship in France was fully comparable to that exerted by Ranke in Germany. The precise scholarship of Waitz found its first French counterpart in the works of François Mignet, which foreshadowed modern French historiography, not only by their high critical standards, but also by their almost uncanny powers of causal analysis and their remarkable lucidity in exposition. The perfection of exact historical methods in France was not due to an individual, as in Germany, but to the labors of many scholars and teachers in the greatest of the world's schools for the training of historians in the refined methods of criticism, L'École des Chartes, which began its work in 1829. The names of Delisle, Guérard, Monod, Luchaire, Molinier, Giry and Viollet are indicative of the quality of work produced by the institution. In Aulard, France possesses a scholar whose detailed and masterly knowledge of a brief period of national history can be equalled among the world's historians only by Gardiner, and the myths surrounding the French Revolution have at last been put to rest. The finest representative collection of French historical scholarship is to be found in the co-operative 'Histoire générale' edited by Lavisse and Rambaud and in the 'Histoire de France' edited by Lavisse. Space forbids more than a brief enumeration of some of the leading members of this recent generation of French scholars who have made the most notable contributions to historical knowledge. C. Jullian has carried the methods of his master, Coulanges, into a thorough survey of ancient Gaul under the Roman Empire. A. Berthelot has distinguished himself by studies in the later Roman Empire and the beginnings of mediæval Europe. G. Bloch has contributed some striking monographs on the transition from Roman to mediæval civilization. C. Diehl has devoted himself to the period of the revival of the Eastern Empire under Justinian. Feudalism has been analyzed by C. Seignobos and A. Luchaire. Seignobos has also rendered valuable service to modern history and to the general history of civilization, while Luchaire is the peerless authority on France of the 11th, 12th and early 13th centuries. C. Langlois has traced the decline of the Capetians. Town life in the Middle Ages has received the attention of A. Giry, who has also contributed the standard treatise on diplomatic. C. Bémont is easily the leading French student of mediæval England, though Ferdinand Lot has done notable work in early French and English mediæval history. C. Bayet holds the same place with respect to the investigation of the Mediæval Empire and has also done signal work on the Byzantine Empire. A. Coville is the master of the period of the Hundred Years' War. C. Pfister has contributed important monographs to mediæval history, the history of Nancy and the administrative policy of Henry IV. The 15th century has received the attention of C. Petit-Dutaillis. H. Lemonnier is the undisputed authority on the history of France in the 16th century. Hanotaux has analyzed the France of the opening of the 17th century. E. Lavisse has also claimed the 17th and holds the first place among French editors of co-operative historical works. H. Vast has surveyed in a brilliant fashion the political history of France in the later 17th and 18th centuries and the era of Napoleon. The 18th century has also profited by the labors of H. Carré and P. Sagnac in the political history of France and Europe, while A. Sorel has mastered the international relations of this century to an unparalleled degree. Aulard's unique work on the French Revolution has been mentioned above. A. Débidour and A. Malet have synthesized the recent scholarship dealing with France in the last century and have done notable work on the history of modern European diplomacy, while H. Mariéjol has covered the history of modern France and Spain, being especially an authority on the early Bourbons. The leading French authority on modern Germany and Austria is G. Blondel, while the similar position with respect to Hungary, Bohemia and Poland must be assigned to E. Denis and L. Leger. A. Rambaud, perhaps the most erudite and versatile figure in French historiography, has earned for himself an enviable position in many fields. Winning his reputation by a monograph on the Byzantine Empire, he has since become the leading French authority on Slavonic Europe and has contributed brilliant surveys of French civilization and the growth of the French colonial empire. All students of the ecclesiastical and political history of Europe are immensely indebted to the masterly reviews of the relation between the Church and the State throughout the history of France by E. Chénon and Débidour. Renan has found his ablest successor in Émile Faguet whose survey of French thought cannot be matched in any other country. Nor should one forget the contributions of E. Levasseur to economic history; of P. Tannery to the history of science; and of C. Langlois to the subject of historical bibliography and methodology. The contributions of other recent French historians will be mentioned in the treatment of special phases of modern historiography. What Ranke achieved for the improvement of the teaching of history in Germany was accomplished in France by Jean Victor Duruy, Ernest Lavisse, Charles Bémont and Gabriel Monod. Monod, probably the most scholarly and stimulating teacher of history who has yet lived, brought to perfection the seminar method which had been introduced by Duruy. In conclusion, no sketch of French historical scholarship would be complete without proper recognition of the unparalleled ability of French historians to unite careful scholarship with a broad interpretation of historical material, an admirable lucidity of expression and rare powers of synthetic organization.

Even more than was the case with France, critical historical scholarship in England was a native product. Beginning in the work of such men as Freeman, Stubbs, Green, Lecky, Creighton and Seeley, it has reached its highest point in the work of Samuel Rawson Gardiner on the stirring events of the first half of the 17th century. For a thorough mastery of all the available sources for a limited period and the ability to organize these in an intelligible narrative he has but one rival, Aulard, and the objectivity of his work surpasses that of the Frenchman. The English have never, however, provided anything comparable to the École des Chartes or the Historical Institute at Vienna for the training of young historians in the most recent methods of exact critical scholarship. The great repertory of the best products of recent English historical scholarship is the co-operative works — the incomplete 'Cambridge Mediæval History,' the 'Cambridge Modern History,' and the less pretentious series edited by Hunt and Oman. Any catalogue of the modern leaders of English critical historical scholarship would certainly include the following names. N. H. Baynes has dealt with the Eastern Roman Empire, a field which has been more extensively cultivated by J. B. Bury, whose thorough and versatile scholarship has also been demonstrated by work on the later Roman Empire, by his critical edition of Gibbon and by his planning of the 'Cambridge Mediæval History.' The mediæval history of both England and continental Europe has profited by the labors of C. W. Oman, who has also distinguished himself in the field of modern history by a comprehensive work on the Peninsular War. H. C. W. Davis, one of the most brilliant of the younger present-day mediævalists, has contributed notable work on the whole field of mediæval history, but particularly upon the 11th and 12th centuries. T. F. Tout has dealt with England in the 13th and 14th centuries, as well as with the relations between the Church and empire in the Middle Ages, from a broad and well-balanced point of view. J. H. Round has exhibited exceptional scholarship by his studies of English feudalism and mediæval legal institutions. The work of the late F. W. Maitland on the social interpretation of English legal institutions marked the greatest advance in that field since the time of Stubbs. The work of James Bryce on the Mediæval Empire has never been superseded, though H. A. L. Fisher has more recently turned to that subject with both insight and scholarship. Ernest Barker has contributed a number of scholarly monographs on diverse phases of mediæval history. G. M. Trevelyan has dealt with England in both the 14th and the 17th centuries in works which not only exhibit original scholarship, but also the finest mastery of English prose to be found among critical English historians of the present day. The careful scholarship of Richard Lodge has been displayed in the treatment of the transition from the mediæval to the modern period in both England and continental Europe. J. A. Doyle's account of English colonization in America is, perhaps, surpassed only by the American work of Professor Osgood. James Gairdner's calm and scholarly work on the 15th century and the Tudor period has been carried on by A. D. Innes, H. A. L. Fisher and A. F. Pollard, the latter one of the most original and promising writers now engaged in the field of English history. G. W. Prothero has sketched the later 16th century and has secured for himself a position as an historical editor comparable to that held in France by Lavisse. It is a sufficient commentary on the work of C. H. Firth on the history of the middle of the 17th century to observe that the scholarship of Gardiner has not suffered in the work of his continuator. That Lecky's great work on the 18th century did not doom his successors to barren efforts is shown by the works of L. S. Leadam and W. Hunt, C. G. Robertson's narrative on the early Hanoverians, G. O. Trevelyan's survey of the American Revolution and by the biographies of the elder Pitt by Rosebury and Williams, of Burke by Morley, of Fox by Trevelyan and of the younger Pitt by Rose. Stanley Leathes has no English competitor as an authority on the political history of France. F. C. Montague and J. R. M. Macdonald have investigated the history of 18th century France, and H. Morse Stephens contributed the first scholarly synthesis of the French Revolution before he left his native land to win academic distinction in the United States. J. H. Rose is the undisputed English authority on the Napoleonic period, while H. A. L. Fisher has been attracted by Napoleon's administrative reforms. The 19th century has been covered by the works of Spencer Walpole, Herbert Paul, G. Slater and J. A. R. Marriott and by a number of notable biographies, such as those of Francis Place by Graham Wallas, of Cobden and Gladstone by Morley, of Bright by G. M. Trevelyan and of Disraeli by Monypenny and Buckle. The history of the British Empire has received detailed attention from Egerton, Lucas Innes and H. H. Johnston. European politics and international relations in the last century have been dealt with by W. A. Phillips, G. L. Dickinson and J. A. R. Marriott. In addition, there should be mentioned the exhaustive scholarship of A. W. Ward with respect to all things connected with the political history of modern Germany and the detailed studies of W. H. Dawson on the modern German Empire; the scholarly work of R. N. Bain, R. W. Seton-Watson, D. M. Wallace, F. H. Skrine and W. Miller on Scandinavian, Slavonic and eastern Europe; the studies of Italian unification by Bolton King and G. M. Trevelyan; and the comprehensive work of Martin Hume on modern Spain. Church history has not been neglected in England, the more notable products in this field being the works of H. M. Gwatkin and F. J. Foakes-Jackson on the early Church; of H. B. Workman on the Mediæval Church and the preliminaries of the Reformation; of C. Beard and T. M. Lindsay on the Reformation in general, and of James Gairdner and R. W. Dixon on the Reformation in England; of R. W. Church and F. W. Cornish on the religious movements of the last century; of H. W. Clark on the Non-Conformists; and the monumental co-operative history of Stephens and Hunt on the whole period of English ecclesiastical history. The contributions of Cunningham and Ashley to economic history and of Morley, Stephen, Benn and Merz to intellectual history will be dealt with in another place. Finally, no student of historiography could fail to commend G. P. Gooch for his excellent execution of Lord Acton's long-deferred plan to sketch the development of modern historical writing. Of the teachers of history in England who have done the most to inspire their pupils with the ideals of modern criticism and with an interest in historical investigation Freeman, Seeley, Acton and Maitland have had the widest and most salutary influence.

The beginning of modern critical scholarship in the field of American history dates back only to about the period of the close of the American Civil War. It owed its origin very largely to the influence of Germany. In the first quarter of the 19th century George Bancroft had attended the lectures of Heeren and had later been a friend of Ranke. Not having been an academician, Bancroft had little influence on scientific historical methods in the United States. The real beginning of the systematic introduction of the improved methods of German historical scholarship into the United States began in the year 1857 when Henry Torrey succeeded Sparks at Harvard, Francis Lieber assumed his professorship at Columbia, and Andrew D. White accepted a chair of history at Michigan. All of these men had been trained in Germany and established a direct contact between German and American scholarship. Professor White had also been profoundly influenced by Guizot, and his teaching was never limited to the narrowly episodical and political history which attracted the extreme disciples of Ranke and the Prussian school. A still greater impulse to the sound establishment of historical scholarship in America came when Herbert Baxter Adams instituted the teaching of history in Johns Hopkins University in 1876 immediately after the conclusion of his studies in Göttingen, Berlin and Heidelberg. To Prof. H. B. Adams was due not only the establishment of the «seminar» method of instruction in America, but also the organization and creation of the first great training school for historians in America. There is scarcely a great American university at the present day which does not have in its department of history one or more men trained in the Johns Hopkins seminar, and the literary products of this seminar were the first conspicuous exemplification in America of the newer critical historical scholarship. Much the greatest personal influence in the introduction of the German methods and ideals was that of Professor John William Burgess, who began his work at Amherst in 1873 after having studied in Göttingen, Leipzig and Berlin and who founded in 1880 the famous faculty of political science at Columbia, which came to rival and later to overshadow Johns Hopkins. Professor Adams, while appreciating the value of the exact German methods, had a healthy confidence in the ability of American scholars to interpret and apply the new methods, but Professor Burgess was convinced that at best Americans could be but lame and halting imitators of Germanic genius and induced most of his students to finish their studies in Germany. As Prof. H. B. Adams has expressed it, «The students of Professor Burgess went to Berlin in shoals. They went in such numbers that they began to be called the 'Burgess School.' They all went to hear Droysen lecture; and came home with trunks full of Droysen's 'Preussische Politik' and of the writings of Leopold von Ranke.» In addition to the work of Johns Hopkins and Columbia, Michigan advanced the new methods under Charles K. Adams, and Cornell under President White, Moses Coit Tyler and George Lincoln Burr. About this same time Edward Channing, at Harvard, carried to completion the beginnings in the newer historical scholarship which had been made by Henry Adams in the «seventies.» At the present time the new scholarship has permeated the whole American university world and the American students of history need no longer, as Professor Gooch would seem to indicate, seek their training abroad. In the seminars of such scholars as Herbert L. Osgood, William A. Dunning, George Burton Adams, J. F. Jameson, Frederick Jackson Turner, George Lincoln Burr, Edward Channing, Edward G. Bourne, Dana C. Munro and Charles H. Haskins the serious American student has received or may receive training in refined critical methods quite equal in most respects to anything to be obtained abroad. The French influences have to some degree displaced the German in recent years and most American mediævalists finish their training in the École des Chartes, a substitute for which scarcely exists in America. A number of American scholars, such as H. B. Adams, E. G. Bourne, B. A. Hinsdale, N. M. Trenholme, F. M. Fling, Henry Johnson, H. E. Bourne, W. H. Mace, J. M. Vincent and F. H. Foster, have made worthy contributions to the systematic elaboration of historical methodology, but nothing has appeared in this field in America that in any way rivals the works of Bernheim or Langlois and Seignobos. Any account of the introduction of the modern methods of historical research in America would be incomplete without some mention of the work of Prof. Albert Bushnell Hart of Harvard. While he has not contributed notably to the further refinement of critical methodology in historiography by his own works, there can be no doubt that he has been easily the leader in promoting the production of scholarly contributions to the field of American history and government, in his capacity as an editor, and in popularizing the more scholarly methods.

The application of the more critical methods to the field of American history has resulted in works worthy to rank with the best European products and has quite reconstructed the earlier notions of American national development. The period of colonization has been examined by Professor Osgood a student of Professor Burgess and Ranke, and his monumental seven volume work on the American Colonies constitutes the highest point to which exact American scholarship has attained, and is worthy to rank with the writings of Gardiner and Aulard. The relation of the colonies to British foreign policy has been recast by Professor Osgood's disciple, George Louis Beer. Professor Alvord, in a scholarly and original work, has for the first time shown the full significance of the problems of British imperial administration west of the Alleghenies for the preliminaries of the American Revolution, and has finally rescued the study of the beginnings of that conflict from the octopus of Boston Harbor. Fisher, Flick, Siebert, Tyler and Van Tyne have at last dealt fairly with the Loyalists. The study of the period of the formation and adoption of the American constitution has finally been secularized through the detailed and critical research of Prof. Max Farrand and the brilliant essay of Professor Beard. Professor McMaster has surveyed the first 70 years of national development with not only scholarship, but a broader and more synthetic approach than has been attained in any other comprehensive American historical work. Much more superficial and narrow in its scope, but equally scholarly is Henry Adams' detailed account of American foreign policy in the administrations of Jefferson and Madison. Professor Turner and his students have applied something of the scholarship of Osgood and the originality and the breadth of interest of McMaster to a study of the colonization of the West, and their work has in many ways superseded the vigorous and interesting survey by Roosevelt. Professor Turner's «school» is the best illustration in America of the combination of exact scholarship with the synthetic tendency in modern historiography. The period of the Civil War and Reconstruction has been dealt with in a calm and temperate fashion by Mr. James Ford Rhodes in a detailed work which for objectivity and scholarship furnishes the only rival to that of Professor Osgood. The same period and the subsequent generation has been covered in an exhaustive manner by Professor Dunning and his students. Dr. E. P. Oberholtzer, a disciple of Professor McMaster, has made a promising beginning in the attempt to present a detailed analysis of the history of the people of the United States since the Civil War, interpreted in the original and comprehensive spirit of his master. The whole period of national history has been sketched in a careful and dispassionate manner by James Schouler, and Professor Channing is engaged on an ambitious attempt to trace the history of the United States from the period of colonization to the present in a work designed to synthesize the results of the critical studies of the present generation of historical scholars, and which, if completed, bids fair to become the great national history in the better sense of that term. The character of the best American historical scholarship in the first generation of those who had imbibed the newer critical methods is to be discovered in the co-operative 'Narrative and Critical History of America,' edited by Justin Winsor. A much more comprehensive and representative repertoire of American scholarship of a slightly more recent type is to be found in the 'American Nation,' edited by Professor Albert Bushnell Hart. In addition to investigation of the history of their own country, American historians have made important contributions to many other periods and phases of history. Professor Breasted has earned a place among the leaders of modern Egyptology and Rogers, Hilprecht, Jastrow, Olmstead and Goodspeed have done creditable work on the history of Babylonia and Assyria. Professor Ferguson is the world's foremost authority on Hellenistic Athens, Westermann has dealt in an original fashion with the provinces of the Roman imperial system, and Botsford ranged over the whole period of classical antiquity with both insight and the most exacting scholarship. In the field of mediæval history Professor Burr has mastered the Carolingian period and is easily the leading authority in Europe or America on the history of toleration; Larson has investigated the early mediæval history of England and Thompson has dealt with the growth of the French monarchy under Louis VI; Munro had devoted himself particularly to a study of the Crusades; the part played by the Normans in the history of mediæval Europe has been investigated by Haskins with a thoroughness not equaled by any other American or European scholar; few if any English scholars can rival G. B. Adams' knowledge of the constitutional history of mediæval England; Henderson has summarized the results of modern scholarship dealing with mediæval Germany; Emerton has contributed scholarly and detailed manuals covering the entire mediæval period; Lynn Thorndike has recently presented an original synthesis of the best modern scholarship dealing with the Middle Ages, and H. O. Taylor has furnished the best survey of the intellectual history of this period. The original and now generally accepted thesis that the «commercial revolution» rather than the «Renaissance» or the «Reformation» marked the dawn of the modern world has furnished the centre of orientation for the stimulating works of Abbott, Shepherd, E. G. Bourne, Merriman and Cheyney. The French Revolution and the Napoleonic period have profited by the works of H. M. Stephens, Fling, Sloane, H. E. Bourne and Johnston. Thayer has written in an interesting fashion on the history of Italy from the end of the Napoleonic régime to the completion of unification; Henderson, Schevill, Ford and Fay have treated the history of modern Germany; Lybyer has been the only American historian to devote special attention to the modern history of southeastern Europe; and C. M. Andrews and Hazen have contributed standard political narratives on the history of modern Europe. In Prof. John Bassett Moore the United States has the most productive and authoritative student of the history of international law and diplomacy, and D. J. Hill, J. W. Foster, A. C. Coolidge, C. R. Fish and E. S. Corwin have been some of the other American writers who have contributed to this field. Church history has attracted a large number of American students. H. C. Lea's monographs have entitled him to rank with European scholars like Harnack and Duchesne. G. P. Fisher and Philip Schaff sketched the whole history of the Christian Church. McGiffert won an international reputation by his edition of Eusebius and has since made important contributions to the history of the early Church. The rise of the mediæval Church has received the attention of Ayer and Flick. The period of the "Reformation" has been covered by the monographs of Preserved Smith, Emerton, Faulkner, Jackson and Jacobs. W. Walker has provided a survey of Church history in both Europe and America. David Schaff, S. M. Jackson and W. W. Rockwell have contributed to this field by valuable editorial labors, and Professor Rockwell has been especially active in keeping Americans in touch with the latest developments in European scholarship in this field. The primary attention of European historians to ancient and mediæval history — a lingering effect of humanism and romanticism — has left its impress upon American scholarship and has led to a neglect of modern history. The younger generation of American historians, however, by devoting their energies primarily to modern history, have tended to make a salutary break with tradition and are promising to equal in volume and quality the contributions that their former teachers made to the study of the "Middle Ages."

Historical biography in the United States has tended to take the form of a great number of brief biographies, such as the "American Statesmen Series" and the "Riverside Biographical Series," rather than being limited to a few notable products. Some fine biographies have appeared, however, such as the voluminous documentary biography of Lincoln by Nicolay and Hay, the excellent biographies of Buchanan and Webster by G. T. Curtis, and the more recent ones of Douglas by Allen Johnson, of Andrew Jackson by J. S. Bassett, and of Stephen Girard by J. B. McMaster.

XI. The Industrial and Scientific Revolutions and the Leading Tendencies in Modern Historiography.

1. The Persistence and Development of Earlier Trends.— While the major portion of the progress in historiography since Ranke has consisted in rise of new and sounder tendencies there have been important improvements in the earlier and traditional lines of development.

In the first place, while little has been achieved that was not implicit in the methodological system of Ranke, there have been some important improvements in both the critique and the technique of historical methodology since Ranke's time. The fundamental principles of historical criticism have been refined and systematized in the admirable works of Bernheim and Langlois and Seignobos, so that the beginner may now have at his disposal a more extended discussion of all phases of historical method than Ranke was ever acquainted with. There has also been a great improvement in the mechanical accessories of historical scholarship. Elaborate bibliographies of the historiography of the various countries have been prepared, of which those by Langlois, Molinier, Monod, Dahlmann-Waitz and Gross are the more notable. These are supplemented by current lists of the new works which appear, published in the various technical historical journals, and the student is enabled to keep thoroughly abreast of the literature in his field. Remarkably thorough and accurate guides to the vast collections of sources of national and ecclesiastical history which were gathered during the 19th century have been provided, and the modern student may locate in a few minutes in any great library sources which might have occupied any earlier generation in months of fruitless searching. Of this invaluable type of aid the monumental works of Potthast and Chevalier are most worthy of mention. Again, archives, public and private, have been opened more freely to the historical scholar, though he is still excluded from the more recent material. Nor should one neglect to point out the great contribution to efficiency, expedition and accuracy in historical investigation which has come about from the general introduction of card catalogues, filing systems, loose-leaf note books and elaborate schemes for indexing and cross-reference. This important type of innovation and improvement has been chiefly the work of American scholars. As important as the advances in bibliographical and other mechanical aids has been the great extension and improvement of the teaching profession in the department of history. Under the guidance of trained scholars, the members of historical seminars, though of mediocre literary talent may contribute more exact knowledge to the field of history in their dissertations than was contained in many volumes of the older and popular literary history. Finally, historical science has, after two centuries of delay, followed the lead of natural science and become co-operative in the true sense of the word. National historical societies have been formed in all the leading countries, each supporting one or more technical journals. It is also rare now that a single authoritative historian attempts a comprehensive survey of a wide field of history; it has rather come to be the general practice to produce extensive histories on the co-operative plan in order to utilize to the full the ability of specialists. It would seem that historiography can make little more progress in the refinement of critical methodology. It only remains to bring modern history as far as possible under the control of the same exact apparatus of research that has already been provided for mediæval and church history.

A less salutary type of persistence of older tendencies has been the perpetuation of the political fetish of Ranke and his school. A number of causes have accounted for this rather curious survival of a strange distortion of historical interests. In the first place, a great impulse was given to the political orientation through the students and disciples of Ranke who held steadfastly to the tenets of their master. This was superseded in Germany by the more violent nationalism and political predilection of Droysen, Treitschke, Von Sybel and the others of the Prussian school. The rise of nationalism and political interests in France under the Third Republic kept alive the earlier nationalistic political history that had before been stimulated by the interest in the episodes of the French Revolution and the conquests of Napoleon. In England the universal conviction as to the supreme political capacity of the Anglo-Saxon seemingly imposed a moral obligation upon English historians to concentrate their attention upon the proofs of this superiority. In America the political and episodical historiography was stimulated by the thrills of a great and successful war in behalf of national unity and was perpetuated by the introduction of the tenets of Ranke and Droysen by their returning pupils, who became the leaders and organizers of historical study in this country. Finally, this type of history received a last source of inspiration from the recrudescence of nationalism throughout the world as an inevitable accompaniment of the imperialism or «neo-mercantilism» which developed more or less universally in the period of the «seventies» and the following years. That the adherents of this form of history will gain at least momentary strength and encouragement from the revived importance of nationalism and militarism growing out of the present World War is scarcely to be doubted.

2. New Developments in the Study and Interpretation of History.— Important as has been the further development of earlier tendencies in historiography during the 19th century, this has been dwarfed into insignificance by the great advances made in totally new directions or in channels which had been only slightly foreshadowed and anticipated in earlier epochs. The critical political historians provided modern historiography with its accurate methods of research and its vast compilations of primary sources. But, as Professor Shotwell has very aptly said, these scholars were so intensely absorbed in the task of perfecting the methodology of research that they failed to discriminate in the importance of the events which they narrated. It has become the task of an ever-increasing group of progressive historians to promote the synthetic tendency in the hope of giving history a more natural content and a better balanced body of subject-matter. While there can be no doubt that the basis for many of the new developments was laid by the progress of earlier periods in the way of creating the national constitutional state, expanding the European consciousness throughout the world by the commercial revolution, and encroaching upon the field of the mysterious through the great scientific discoveries in the field of natural science during the 17th and 18th centuries, there can be no question that most of the novel elements introduced into the writing and the outlook of the historian in the last century were the product of the vast transformations in social conditions and intellectual interests and attitudes since the first quarter of the 19th century. The chief reason for the great transformation in the historical outlook in the last century has been the fact that the «Industrial Revolution» and the progress in natural and social science have completely altered not only the material conditions of human life, but also the whole «Weltanschauung» of the civilized world. A more complete reconstruction of the whole mode of life and of the intellectual orientation of civilized peoples has been achieved in the last century than had previously taken place since the beginning of the Christian era, and this great change could not but affect historical concepts viewed as an important branch of intellectual interests.

By the industrial revolution, which was effected between 1750 and 1850, the whole basis of life was profoundly modified and the former ideas and interests quite uprooted and dislocated. The old period of rural stability and repetition was broken up and with the growth of cities the possibilities of invention, imitation and progress were immensely increased. The changes in the centres of population and in the mode of life gave rise to new and strange social problems on a scale hitherto unknown, and demanded the provision of some adequate «science of society» to serve as a guide in their solution. As in the period of the so-called «Renaissance,» humanity again loomed larger than the state and social rather than purely political interests forged to the front in historical as in other social sciences.

Not less consequential and epoch-making were the notable advances in natural science in the 19th century which were much more destructive to the traditional philosophy of life than the great discoveries of the 16th and 17th centuries, in that the scientific work of the earlier period centered chiefly in the realm of mechanics and other fields which did not directly concern the problem of the origin and destiny of man, while those of the 19th century had a direct and inevitable bearing upon the interpretation of the derivation and origin of the human race and its relation to the rest of the organic world. Lyell and his fellow geologists revealed the undreamed-of antiquity of the earth and of various forms of animal life. Lawrence, Lamarck, Chambers, Darwin and Wallace, working from both geology and biology, suggested and later proved the gradual and «natural» development of man from the lower varieties of the animal kingdom. The chronology of Africanus, Eusebius and Jerome was discredited for all time through the revelations of pre-historic archæology in the hands of Boucher de Perthes and Sir John Evans, and the 'Chronicle' of Jerome was replaced by the 'Classification ethnologique' of de Mortillet. «Adam» was reduced, in the new perspective of time, from the originator of the race to a fairly close contemporary of Darwin himself. Man was revealed as the product of natural causes and not of a mysterious creation, in the old and obscurantic sense of the term, and he became, thereby, a legitimate subject for analysis, particularly at the hands of psychology. Along with this progress in natural science went a much further development of critical philosophy and the subjection of scriptural authority and sacred history, already weakened by the established conclusions of scientific investigations, to the same candid and critical investigation which has been accorded to secular history much earlier. The spirit of

Voltaire, Hume and Gibbon had at last permanently come to its own.

It was inevitable that these sweeping alterations in man's outlook upon life should profoundly affect his attitude toward the study of the past, as well as his interests in the present and future. In view of the fact that the industrial revolution was the prime mover in the social transformations of the period it was not surprising that the first vigorous reaction against the conventional political historiography should come through the avenue of a greater emphasis upon the economic factors and the commonplace facts of daily life, the primary importance of which was demonstrated by the historical events of the 19th century. To be sure, the rationalist school had laid considerable stress upon economic influences, Heeren had shown the importance of the commercial activities of antiquity, and Möser had insisted upon the vital relation of economic factors to the development of political organization, but these were only isolated instances of more than the usual contemporary insight and profundity which were almost totally overshadowed and engulfed in the episodical and biographical historiography of romanticism and in the political bias of nationalistic historiography. Economic history, as a general and universal movement of revolt from the narrow political historiography, dates from the publication of Karl Marx's pamphlet entitled, the 'Holy Family,' in 1845, and his joint work with Engels three years later, the 'Communist Manifesto.' While few of the leading figures in modern economic history would defend the economic determinism of Marx, they would at least contend that economic events have an historical significance not second to any other category of facts, and that to pass over them in silence, as did writers like Droysen and Sybel, Stubbs and Freeman, and Burgess and Holst, is to miss much of the significance of any period and inevitably to yield but an imperfect and distorted picture of any epoch. It is important to note that the new economic history was not a break with the exact scholarship of the school of Ranke, but was rather an application of critical scholarship to the recovery of our knowledge of the economic life of the past in its relation to the totality of civilization. In the names of Roscher, Knies, Inama-Sternegg, Nitzsch, Schmoller and Bucher in Germany; of Rogers, Cunningham, Ashley, Gibbins, Hammond and Webb in England; of Levasseur, LePlay, Leroy-Beaulieu, Avenel and Jaurès and his associates in France; of Kovalevsky and Vinogradoff from Russia; and of Bolles, Veblen, Bogart, Coman, Dewey, Clark, Commons, Gay, Callender and Day in America, the student of historiography recognizes scholars worthy to rank with the best disciples of Ranke in the field of critical methodology. In addition to the epoch-making work of the avowed economic historians, this new emphasis upon economic factors in history has filtered into the works of the orthodox school, and few serious historical works are now attempted which do not give at least grudging recognition to the importance of the industrial and commecial life of a people.

Another important new development in historical writing which grew more or less directly out of the effects of the industrial revolution was the origin of sociology and the influence of the sociological point of view upon historical writing. While there had been sociological tendencies in the writings of earlier publicists and historians, it is generally agreed that the science of sociology had its origin in the necessity of providing a general "science of society" to criticize, evaluate and guide the various reform movements which sprang into existence as a result of the evils of the social and economic transition which accompanied the industrial revolution. Its two great original systematizers were Auguste Comte and Herbert Spencer. The influence of sociology upon history has been varied and profound. One aspect of this influence was evident in Buckle's avowed desire to follow Comte's suggestion of the existence of well defined laws of historical development and to combine this with Quetelet's statistical method of measuring social phenomena, and thus to arrive at an exact science of historical development wholly comparable to the precision reached in natural science. While Buckle's suggestions have been only moderately developed, it has long since been recognized that few valid laws of historical development can be discovered which do not rest upon the firm basis of adequate statistical study. A much more far-reaching reaction of sociology upon historiography has been its influence in broadening the content of history, so as to include all of the important phases of social life and activity. This type of departure from orthodox procedure gained its first great success in the world famous work of John Richard Green. Less popular but equally able were Professor Dill's volumes on the social phases of Roman imperial history. While Green found few immediate followers among his countrymen, who, with the exception of Lecky, for the time being held faithfully to the canons of Freeman, Stubbs and Seeley, the younger generation, led by such scholars as Pollard, Marvin, Zimmern and Slater have organized a powerful movement in favor of a revival of Green's broad social mode of approach to historical problems. Germany has probably been most prolific in the production of historians affected by the sociological movement. In the middle of the last century Riehl and Freytag gathered data for the first comperhensive picture of the social history of Germany, Friedländer described the social life of the Roman Empire, and Buckhardt drew the classic picture of the civilization of the Renaissance. A quarter of a century later Janssen, from a warmly Catholic standpoint, described the social conditions of Germany in the epoch of the Reformation. Erman provided the first reliable and comprehensive account of the civilization of ancient Egypt. The great impulse to social history in Germany, however, came though the labors of the able Leipzig professor, Karl Lamprecht, and his supporters and co-workers Gothein, Steinhausen and Breyssig. In France the effect of the new social impulses has been less apparent because the French historians have never been so narrowly political as the German and English schools of history — even such technical and ultra-critical mediævalists as Luchaire, Giry and Monod finding time to discuss social conditions in the mediæval period. Rambaud is probably the nearest French counterpart to Green. The far greater breadth of view in French historiography than in English can best be appreciated by a comparison of the tables of contents of the 'Histoire générale' and the 'Histoire de France' with those of the 'Cambridge Mediæval History' and the 'Cambridge Modern History.' In Italy, Ferrero has upheld the social point of view in his history of ancient Rome. Worthy and successful imitations of Green's sociological mode of interpretation are to be found also in Blok's 'History of the Dutch People,' and in Kluchevsky's publication of his lectures on the development of the Russian national culture and political organization. Among American historians McMaster has followed most faithfully in the footsteps of Green, and Turner has exhibited a breadth of view not less notable than his exacting scholarship in tracing the colonization of the West. Cheyney's work in the field of English history has always been marked by a broad and well-balanced interpretation. Nor should one forget the promising beginnings in a social interpretation of American history by such writers as W. E. Dodd and Carl Becker, and the application of similar methods to modern European history by Hayes, Lingelbach and others. Professors Breasted and Jastrow have done notable work in reconstructing the civilization of oriental antiquity. Finally, Professor Shotwell of Columbia, while his own written contributions have not been extensive, has rivalled Maitland in stimulating an enthusiastic interest in social history on the part of an ever increasing group of disciples. Another very significant outgrowth of the sociological movement has been its reaction upon the field of constitutional history. While Möser had anticipated the recent movement in stressing the creative influence of social and economic forces in shaping political forms and institutions, the first great modern school, of constitutional historians, represented in Germany by Waitz and Gneist, in England by Stubbs, and in America by Holst and Burgess, had been content to trace constitutional development in a purely external and formal legalistic manner, or had represented it as a product of the influences of powerful personalities. The spirit of Möser first reappeared in the uncompleted work of Alexis de Tocqueville on the constitutional developments in 18th century France, which forever discredited the cataclysmic interpretation of the French Revolution by showing how it was the natural and logical culmination of fundamental social and economic forces which had been operating for centuries. A similar mode of approach was evident in the brilliant contributions of Fustel de Coulanges to the constitutional history of France in the early mediæval period. The influence of social and psychic forces in legal and constitutional history was fully recognized in Otto Gierke's monumental work on "Genossenschaftsrecht," perhaps, the most notable German contribution to the newer tendencies in constitutional interpretation, and also in Brunner's monumental history of early Germanic law and Ihering's extensive studies in comparative jurisprudence. What Tocqueville and Coulanges accomplished for France was achieved for English constitutional history by the powerful, original and unbiased mind of Gierke's disciple, Frederick W. Maitland, who for the first time effectively demonstrated the social and economic background of English legal history and made clear the futility of a purely legalistic reconstruction of constitutional development. Maitland's work in English legal history has been carried on by his friend, Paul Vinogradoff, with a more impressive, if less subtle, scholarship, and with equal productivity. In America a worthy disciple of Maitland has appeared in Prof. Charles A. Beard, who not only shares Maitland's approach to constitutional problems, but rivals him in his disregard of traditional and orthodox opinions.

A direct outgrowth of the industrial revolution which has been of the utmost significance for both historical events and historiography has been the neo-mercantilism or national imperialism which has developed since about 1875 as a result of the need for new markets and investment opportunities which was created by the increase of both commodities and capital through the great revolution in industry between 1800 and 1875. The process has repeated in a much more thorough-going way the commercial revolution of three centuries earlier. European civilization was again brought into contact with different cultures of every conceivable type, and the possession of the scientific knowledge that had been accumulating since 1650 was of the greatest value and assistance in appropriating the new discoveries. The reactions of this movement upon historiography have been nearly as diverse as the civilizations and cultures which have been discovered. Its more unfortunate results have been a perpetuation of ardent national sentiment in historical writing and a stimulation of racial egoism on the part of European and American historians. Its more favorable effects upon historiography, as exhibited in the writings of the more thoughtful historians, have been a broadening of the knowledge of mankind, the enriching of the stores of historical information, an increase of tolerance for cultures different from our own and the great stimulation of the attention of the historian and publicist to the new social, economic and administrative problems created and to their solution in harmony with the principles of enlightenment and humanity. Among the historians and publicists who have given especial attention to these subjects have been Bryce, Douglas, Hobhouse, Hobson, Johnston, Keltie, Kidd, Lewin, Macdonald, Rose and Skrine in England; Bordier, Cordier, Gaffarel, Leroy-Beaulieu, Piquet and Rambaud in France; Meinecke, Meyer, Peters and Zimmermann in Germany; and Blakeslee, Harris, Hornbeck, Jones, Keller, Krehbiel, Latourette, Morris, Reinsch and Shepherd in America. On the whole, the movement has tended to broaden the historical outlook not only with respect to geographical space, but also with regard to the scope of the historian's interests. Especially significant has been the interest that it has aroused in the history of international relations.

A further significant innovation, which was in part a product of the concentration of population due to the industrial revolution and in part an outgrowth of the more scientific approach to the study of social and psychic phenomena, has been the rise of social psychology and its reaction upon history. Voltaire had foreshadowed the psychological interpretation by his doctrine of "the genius of a people," but this concept in the hands of Voltaire was essentially non-historical. He regarded national character as something fixed and immutable, and he made little attempt to explain its origin. The romanticists had improved somewhat on Voltaire's conception by viewing the development of civilization as the product of obscure psychic or spiritual forces, but they even denied the possibility of discovering or analyzing the nature or operation of this process of psychic causation. Ranke and his school had borrowed from the romanticists the doctrine of the 'Zeitgeist,» but they had been content to describe its varied manifestations in different periods and made no attempt to analyze its content or to account for its origin or mutations. With the growth of cities and the means of communication during the industrial revolution and the resulting increase of social contacts and of the volume of psychic interstimulation, and with the development of modern science with its emphasis upon the amenability of human activities to psychological analysis, there gradually arose a science of collective or social psychology, which first made its appearance in the work of Lewes, Bagehot, Lazarus and Steinhal and was developed by Wundt and Dilthey in Germany; by Fouillée, Guyau, Tarde, Durkheim and Le Bon in France, by Sighele in Italy; by McDougall, Trotter and Wallas in England; and by Giddings, Sumner, Ross, Cooley and Ellwood in America. While this novel development of psychology was at first applied either to abstract or contemporary problems, it soon began to react upon historical interpretations. If the collective psychology was so all-important a factor in recent times it was natural for the original historian to ask the question as to why it had not been of fundamental significance in every age. From a semi-obscurantic view of a «Weltgeist» and a «Zeitgeist,» which were either held to be unanalyzable or were left without analysis, the progressive historians turned to an attempt to discover and evaluate the factors which have produced the particular collective psychology of various ages and peoples, and to an effort to account for the transformations of intellectual reactions through the centuries. This line of approach was foreshadowed by Comte's famous formulation of the three stages of the development of psychic reactions. The transition from romanticism to the more scientific collective psychological approach was best exemplified by Taine, who was never quite able to free himself from the obscurantic trends of romanticism. The first and the most distinguished exponent of this newer line of approach to the interpretation of history through the genetic study of the transformation of the collective psychology was the original Leipzig professor, Karl Lamprecht, who not only set forth an elaborate theoretical justification of his methods, but also illustrated them in a monumental survey of German history. Lamprecht's principles have been valiantly defended by some enthusiastic and progressive scholars in every civilized country. While the avowed exponents of the value of an interpretation of history in terms of the changing attitudes of the intellectual classes have as yet been relatively few, the volume of literature which has been produced by them and others which serves to substantiate their thesis has already become considerable. In England Lecky's youthful but brilliant study of the development of rationalism in modern times; John Morley's voluminous appreciation of the contributions of the French «Philosophes» of the 18th century; Leslie Stephen's masterly sketch of the intellectual history of England in the same period; Poole's study of mediæval thought; the solid contributions of Barker, Figgis and Carlyle to political thought from classical to modern times; the studies in the history of the heroic struggle against obscurantism which have been produced by Bury, McCabe and Robertson; A. W. Benn's survey of English rationalism in the last century; and, above all, J. T. Merz's monumental exposition of the progress of thought and science in 19th century Europe, have been the more notable examples of the growing estimate of the significance of intellectual history. All students of historiography and intellectual history are indebted to the Scotch savant, Robert Flint, for erudite contributions to the history of the philosophy of history. In Germany the more important contributions to this new field have been the massive work of Theodor Gomperz on Greek thought; the brilliant and original contributions of Wilhelm Dilthey and Wilhelm Windelband to the history of philosophy; Adolph Harnack's unique study of the development of Christian dogma; Otto Gierke's great survey of the evolution of certain phases of political theory; and the studies in the history of sociological thought by Paul Barth and Ludwig Stein. France has been creditably represented by the essays of Renan and Émile Faguet; the stimulating studies of the development of human thought from primitive times to the present by L. Lévy-Bruhl; the many brilliant monographs of Émile Durkheim and his school on the most diverse phases of intellectual history; Solomon Reinach's encyclopedic contributions to every department of the history of thought and culture; and the notable works of A. Franck, Faguet and Paul Janet in the field of the history of political theory. In Italy Vico has found a worthy successor in Benedetto Croce, and the Scandinavian nations are ably represented by the labors of Georg Brandes and Harold Höffding. In America this fertile field was first cultivated by John W. Draper, whose once popular works have long since become antiquated. The most widely read American work on intellectual history was Andrew Dickson White's powerful polemic against obscurantism, which probably did more than any other single influence to bring American thought into a proper orientation with the progress of modern science and criticism in every field. Since that time Mr. Henry Osborn Taylor has provided the public with a scholarly survey of the intellectual history of Europe from the period of Roman decadence to Dante. Mr. Henry C. Lea has dealt with several phases of the relation of the mediæval church to intellectual progress. Prof. George L. Burr has devoted his life to an investigation of the history of toleration, the results of which he has forecast in a number of precious articles and monographs. Prof. William A. Dunning has presented the first complete survey of the history of political theory since the publication of the classic work of Janet. Professors W. C. Abbott and W. R. Shepherd have devoted themselves to an investigation of the reaction of the commercial revolution on European thought and culture. McGiffert has sketched the history of modern religious thought in a brilliant fashion. Finally, Prof. James Harvey Robinson has not only aroused an ardent interest in intellectual history on the part of the large number of enthusiastic students who have attended his stimulating lectures at Columbia University, but is now engaged on what promises to be the first complete summary of the transformations in the intellectual reactions of humanity. In this same field of intellectual history probably belong the valuable researches into the history of natural science in its relation to the progress of civilization which have been carried on by Karl Pearson, Shipley and Whetham in England; Du Bois-Reymond, Mach, Ostwald and Dannemann in Germany; Sarton in Belgium; Tannery and Duhem in France; and Sedgwick, Tyler, Libby, and L. Thorndike in America. Here also belong the contributions to the field of the history of æsthetics which has been cultivated by Symonds, Ruskin, Mahaffy and Murray in England; by Winckelmann, Burckhardt, Gervinus, Gregorovius, Woltmann and Lübke in Germany; by Renan, Sainte-Beuve, Taine and Reinach in France; and by Charles Eliot Norton and Ralph Adams Cram in America. Nor should one forget the many stimulating contributions of such writers as James, Royce, Dewey, Hall and Santayana, in the effort to make the more original and helpful trends in philosophy and psychology the common property of the intellectual classes.

The discussion of the extraordinary development of intellectual history in the last half century furnishes the logical transition from a discussion of those recent trends in historiography which have grown primarily out of the industrial revolution to those which have been a product of the remarkable progress in natural science in the last hundred years. As the industrial revolution was the great event in the economic and social history of the 19th century, so the discovery of the Darwinian theory of evolution was the central fact in the development of natural science in this period. While, as Professor Osborn and others have shown, the idea of evolution is an old one which originated in a certain crude and formal sense, at least, with the same Ionic Greeks that began the writing of prose and of history, its true significance as a fact in science and philosophy began with the publication of Darwin's 'Origin of the Species' in 1859. With the subsequent controversies over the details of the doctrine of natural selection one is not here concerned. Its reaction upon the outlook of the alert and progressive historical student was profound. Spencer worked over the whole field of social science from the evolutionary standpoint and gave it a genetic trend and meaning from which it could never escape. Enterprising biologists and sociologists like Schallmayer and Ammon in Germany, Lapouge in France, Galton in England and Keller in America have attempted to work out a science of social evolution conceived in terms of biological evolution carried over into the social field. Others, among them several distinguished historians, have essayed histories of religion and ethics based upon the new revolutionary conceptions and criteria. In this field the work of Spencer, Lecky, Leslie Stephen, Kidd, Hobhouse, Fiske and Sutherland has been most notable. Finally, an attempt to put the history of law and politics upon an evolutionary basis was initiated in the suggestive writings of the "organic" school of sociologists and political scientists and of Maine, Bagehot and Ritchie. On the whole, however, the outstanding reaction of the new evolutionary conceptions upon historiography did not consist so much in the various special phases of their application to historical problems which have been mentioned above as in fixing upon the historian's mind the perception of the genetic nature of the social process and in giving him a firm basis upon which to develop a sound theory of progress.

With the general acceptance of the evolutionary hypothesis as to the origin and development of the human race it was inevitable that much greater attention would be given to the influence of the physical environment upon historical development. The general notion of the effect of physical environment upon human types and their behavior was an exceedingly old one which had originated with Hippocrates and had been passed on through the ages by Aristotle, Strabo, Vitruvius, Aquinas, Ibn Khaldun, Bodin and Montesquieu. While their general observations had some rough similarity to the conclusions of modern students, their explanations of environmental causation were most crude, being based primarily upon the doctrine of the alleged planetary influences upon the physiological processes of the human body. The foundations of a scientific study of the relation between geography and history were laid by the monumental studies of Karl Ritter in the first half of the 19th century, which were interpreted to the public in a more popular form by Guyot. Ritter found a worthy successor in Friedrich Ratzel whose profound and voluminous works are conventionally held to have founded the science of anthropogeography. His researches were rivalled in France by those of Élisée Reclus and were interpreted to the English and American world by his pupil, Miss Ellen Semple. In addition to the systematic works of Ratzel and Reclus, many suggestive contributions have been made to special phases of the influence of geography upon history. Metchnikoff has pointed out the significance of the great river systems of the world in the development of the chief historic civilizations. Demolins has dwelt in detail upon the great importance for history of the configuration of the land which has determined the routes which the peoples have travelled in their various dispersals from original seats of culture. Especially noteworthy has been the suggestive, if not entirely convincing, work of Professor Huntington, whose investigations in Asia Minor have enabled him to ascertain the existence of considerable climatic oscillations in the past which throw new light on the hitherto unexplained problems of the shifting of the centres of civilization from Egypt to northwestern Europe and of the invasions of Europe by successive waves of Asiatic peoples. The net result of this work of students of anthropogeography has been to compel every self-respecting historian to acquire some knowledge of the geographical setting of a nation before attempting to narrate its history. Historians have not been slow to appreciate the value of these significant studies upon the relation of geography to the development of civilization. Professor George has produced a stimulating attempt to indicate the general dependence of history, particularly in its military aspects, upon geographical conditions. Professor Myres has sketched in a brilliant fashion the geographic background of the rise of the earliest seats of civilization. The signifiance of geographical elements in the history of antiquity has been abundantly recognized by Professors Hogarth, Olmstead and Breasted. Ernst Curtius, a disciple of Ritter, for the first time made clear the geographical basis of the history of Greece. Freeman described in great detail the topography of Sicily. Nissen has shown with admirable thoroughness the effect of Italy's topography and situation upon its historical development. The importance of local geographical conditions for the development of national history was made apparent in the case of France by Michelet; with regard to England by Green; for Germany by Riehl; and with respect to the settlement and history of North America by Payne, Shaler, Semple, Hulbert, Brigham and Turner. Finally, Buckle and Hellwald have, with less success, attempted general surveys based upon the conception of the interdependence of nature and the human mind, while Helmolt has presided over the production of the first extensive co-operative history which has made a consistent attempt to emphasize the anthropological and geographical factors in historical development according to the general doctrines of Ratzel. The above bald enumeration of the chief phases of progress in modern anthropo-geography and its contributions to historical interpretation, perhaps, calls for some critical reservations. In no field has there been greater exaggeration of a single set of «causes,» or a more persistent flouting of the rules of critical methodology. Particularly have the adherents of this type of interpretation failed to distinguish between a «conditioning» and a «determining» influence. Finally, it is a generally accepted doctrine among all critical students of cultural evolution that environmental influences decrease in importance in proportion as the progress of science and civilization enables man to subdue nature to his own purposes. For these valuable criticisms of too enthusiastic an acceptance of the geographical interpretation students are more indebted to the analytical anthropologists, such as Boas, Wissler, Lowie and Goldenweiser, than to the criticism of historians.

Even more direct and vital in its influence upon historiography was the new science of anthropology, which, in its modern form, was a product of the new evolutionary concepts applied to the study of mankind as a unity. While not ignoring the contributions of earlier students, modern anthropology owed its origin primarily to the researches and writings of Tylor in England, Bastian in Germany and Boas in America. Its purpose, according to Professor Boas, is «to reconstruct the early history of mankind, and, wherever possible, to express, in the form of laws ever-recurring modes of historical happenings.» The chief point of contact between anthropology and history is found in the attempt of the former to discover and formulate the laws of cultural evolution. With the controversies between the older school of unilateral evolutionists, represented by Spencer, Avebury, Morgan and Frazer, the more recent advocates of the doctrine of «diffusion,» such as F. Graebner, Rivers and Elliott Smith, and the exponents of the so-called theory of «convergent development» of cultural similarities and repetitions, among the most important of whom are Ehrenreich, Boas, Lowie and Goldenweiser, it will be impossible to deal in this place. It will be sufficient to insist upon the fact that no historian can regard himself as competent to attempt any large synthesis of historical material without having thoroughly acquainted himself with these fundamental attempts to bring definite laws of development out of the chaos of historical facts. An attempt to link up cultural anthropology with a dynamic history has recently been made in two thoughtful books by Professor Teggart of the University of California. Dr. Goldenweiser in a recent brilliant article has endeavored to provide a systematic methodological point of departure for scientific history and critical anthropology. Several other significant influences of anthropology in altering the attitude of the historian should be noted. In the first place, nothing could be more destructive of chauvinism or more important for acquiring a proper perspective for the interpretation of historical development than a perusal of the comparative surveys of legal, political, social and religious institutions by such writers as Lippert, Ihering, Tylor, Westermarck, Hobhouse, Durkheim and Sumner. The greatest blow to the venerable myth of the origins of political democracy in the Germanic folk-moot, which it ever sustained, was the discovery that it could be matched among primitive peoples the world over and that it was not the sole possession of the «noblest branch of the Aryans.» Again, while the laws of cultural development which have been formulated by anthropology and the breadth or view inseparable from the handling of anthropological data are of the utmost value to all fields of history, anthropology has a particularly close relation to the field of ancient history in that the beginnings of civilization cannot be properly understood and interpreted without a thorough acquaintance with the background of the primitive culture which preceded the dawn of written history. Finally, anthropology, by its study of mankind as a unity in time and space and especially through its basic premise developed by Bastian of the fundamental unity of the human mind, has for the first time provided a firm basis for a rational conception of the real unity of history.

Closely related to the subject of anthropology, and by some considered a branch of that science, is the relatively recent science of prehistoric and proto-historic archæology. Working in co-operation with geologists and students of paleontology and comparative anatomy the archæologists, such as Boucher de Perthes, Rutot, Breuil, Boule, Déchelette, Cartailhac, Schmidt, Obermaier, Peet and Munro, have revealed the existence of mankind on the earth during a space of time almost beyond the range of human conception. The origins of the race have been pushed back from the few thousand years comprehended in the exact chronologies of Eusebius, Jerome, Usher and Lightfoot to a vague and uncertain period not less than a quarter of a million years ago. The profound modification in the historical perspective which this epoch-making discovery has necessitated is obvious. As Professor Robinson has pointed out, Thales and Herodotus can no longer be regarded as among the «ancients,» but in the new scale of time must be viewed as our contemporaries. Not only has the discovery of the remoteness of human origins fundamentally altered all previous conceptions of the time element in history, but it has given a new impulse to a dynamic theory of progress, in that it has shown that mankind have advanced further in the few centuries that have elapsed since the dawn of written history than they had in the tens of thousands of years previous to that time, and also because it has demonstrated that the rate of progress seems to be accelerated almost beyond comparison as one approaches extremely recent times. Not only have the archæologists rendered almost revolutionary services to history in lengthening the historical perspective, but they have also been of the utmost assistance in increasing the historian's knowledge of «lost civilizations» within what are conventionally regarded as «historic» times. Winckler and Garstang have rediscovered the lost Hittite civilization of ancient Syria. Schliemann, Evans and Dörpfeld, among others, have revealed a flourishing Aegean civilization coeval with the civilization of Egypt in the «Pyramid Age» of the third millenium B.C. The progenitors of the historic Greeks no longer appear as the builders of civilization but as barbarous destroyers who ruined a civilization which they were unable to match for five centuries. Equally significant, though less familiar, are the researches of Déchelette, Jullian, Rice Holmes and others in the history and culture of ancient Gaul, which have exhibited an early north European civilization which was in touch with the Aegean civilization at its height and have thrown into high relief the relative savagery and backwardness of Teutonic culture as it appeared in western Europe at the beginning of the Christian era. No adequate history of Europe can any longer ignore the vital importance of this ancient Celtic culture. In this same department should be placed the epoch-making discoveries in philology and archæology which have allowed scholars to arrive at an accurate and comprehensive knowledge of the civilizations of the ancient East, which had been hitherto known only by allusions in the literature of the Hebrews, Greeks and Romans. About 1825 Champollion deciphered the Rosetta stone, mastered hieroglyphics and laid the foundations of Egyptology. Egyptian chronology and philology were firmly established by Lepsius and Brugsch. Mariette, Maspero and Petrie have led in the excavations that have produced Egyptian archæology. Meyer has revised Egyptian chronology and Breasted has produced the best synthesis of the history of Egyptian civilization. Erman has provided the only detailed study of the social history of Egypt. What Champollion achieved for Egyptology was accomplished for the history of Babylonia and Assyria by Henry Rawlinson through his reading of the Behistun inscription in the middle of the 19th century. Schrader, Delitzsch and Lagarde perfected Assyriology and Semitic philology; Botta, Layard, Sarzec, Hilprecht and Winckler have supervised the all-important excavations of this region; and Maspero, Meyer, Rogers, Goodspeed and King have provided the most reliable narratives of Assyrian and Babylonian history, while Jastrow has drawn the best picture of the culture of these ancient nations.

Another most important development in historiography in the last century has been the gradual but sure secularization of «sacred» history and the consequent removal of the last obstacle to the scholarly and objective treatment of every field of history. This progress has been in part a product of the brilliant advances in the critical methods in the last century, and in part has been due to the philosophical destruction of the whole basis of the conception of «sacred» history, which has resulted from the unparalled discoveries in natural science since 1800. On the whole, it is probable that the latter has been the most important influence because the difference in the skill in handling documents on the part of Mabillon and Wellhausen was infinitely less than the divergence between their «Weltanschauung.» The process through which the sources of the Old Testament were discovered and separated has been briefly discussed in an earlier section of this article and need not be repeated here. Upon the basis of this criticism of the sources there has grown up a critical history of the Jewish nation and its religion which had been impossible of attainment since the inclusion of Hebrew history as the corner-stone of the Christian synthesis of the history of antiquity by Eusebius, Jerome and Orosius. A rather lame and halting beginning of a critical and objective history of the Hebrews, upon the basis of the biblical criticism of the early 19th century, was made by the Göttingen professor, Heinrich Ewald, whose 'History of the People of Israel' was published in the years following 1843. The first straightforward and thorough-going critical history of the religious development of the Jews was contained in the 'Religion of Israel,' published by the Leyden professor, Abraham Kuenen, in 1869. Even more advanced was the epoch-making 'History of Israel' of Julius Wellhausen, a professor in Göttingen and the greatest of Old Testament scholars. Wellhausen's work, published originally in 1878, was but a brilliant fragment, and the preparation of a systematic history of Israel in accordance with the advanced views of Wellhausen was the work of the Giessen professor, Bernhard Stade, whose 'History of the People of Israel' was published in 1887. The results of these works from the new critical mode of approach were utterly to destroy the exaggerations regarding the glories of ancient Israel, which had been set forth in Kings and Chronicles-Ezra-Nehemiah, had been repeated by Josephus, and were thoroughly embodied in Christian tradition. For the first time the history of Palestine was revealed in its proper perspective in the larger history of the ancient East. Not less damaging was the effect of the work of Wellhausen and his associates upon the doctrine of a unique, primordial and revealed monotheism among the Jews. It was clearly shown that monotheism had been a gradual and precarious development out of an original polytheism, and that its maintenance was always difficult and subject to serious lapses. The late origin of the alleged laws of Moses was no less clearly established. The secularizing process was carried still further by the brilliant Cambridge professor, Robertson Smith, in his ‘Religion of the Semites,’ which showed the many points of similarity between the religion of the Hebrews and the religious beliefs and practices of the other branches of the Semitic peoples. Finally, Delitszch, Winckler and Rogers have made clear the profound influence of the Babylonian historical and religious traditions upon the religion of Israel. While the work of the most of these writers was highly technical and intended primarily for scholars, its general significance was popularized through Renan's brilliant and widely-read ‘History of the People of Israel.’ No less startling has been the result of the invasion of the «sacred» history of the Christian era by the critical methods. Building on the basis of the textual criticism of the sources of the New Testament by such scholars as Strauss, Baur, Loisy and Harnack, and the study of contemporary religions by Renan, Hatch, Cumont, Glover, Dill and others, Percy Gardner, Weizsäcker, Conybeare, Wernle, Harnack, Duchesne and McGiffert have explained with great scholarship and lucidity the syncretic nature of Apostolic and Patristic Christianity, the historic causes for the final success of Christianity, and the nature of the gradual development of Christian dogma and ecclesiastical organization. Henry C. Lea, in a series of massive monographs, which constitute the most notable contribution of America to Church history, has dealt with the most diverse phases of the history of the mediæval Church in a fine objective and secular spirit. Beard and Tröltsch have traced the rise and development of Protestantism with insight and candor. Three Catholic scholars of the highest rank in the field of scholarship, Döllinger, Huber and Reusch, have made as great contributions to the battle against ecclesiastical obscurantism as any historians from the Protestant or sceptical camps. Döllinger totally demolished the alleged historical foundations of ultra-montanism and infallibility in his work on ‘The Pope and the Council.’ Huber surveyed the history of the Jesuits with the aim of proving their deadly opposition to the spirit of modern learning and the freedom of thought. Reusch contributed the standard treatise on the history of the Papal Index and threw a flood of light upon the sinister machinery through which the reactionary element in Catholicism has endeavored to perpetuate the credulity of its followers and to exclude the perilous fruits of modern scientific and critical research. The net result of the labors of critical scholars of every religious complexion in the field of «sacred history» has been to destroy entirely the premises of the «Fathers,» which led them to mark off a field of historical development which was taboo to critical research, and it has opened every field to the operation of the same degree of patient research and calm and objective narration.

With the growth of modern natural science and the critical attitude in the appropriation and assimilation of knowledge, the effort to formulate some magnificent and systematic philosophical scheme for the organization and presentation of historical development, such as was devised by Augustine and Hegel, has greatly declined. Scepticism of any formal philosophy of history seems to be but a necessary accompaniment of our increasing knowledge of the infinite complexity of social and historical phenomena, as these attempts to reduce history to such simplicity savor too much of the à priori method, now so thoroughly discredited. To take the place of the older dogmatic philosophy of history there have developed what may be called various «interpretations» of historical data. These at present differ from the older philosophy of history in the absence of any teleological element and in the rejection of the deductive method. They aim solely to emphasize and bring into high relief those factors, which, according to the various schools, seem to have been most influential in producing the civilization of to-day. It is, in short, the attempt to supplement Ranke's aimless search for what occurred in the past by at least a feeble and humble effort to explain how the present order came about. Far from being less scientific than the older program of Ranke, it really constitutes the perfect completion of scientific method in historiography, in the same way that the formulation of the great laws of natural science constitute the logical completion of the task of gathering data by observation and experimentation in the laboratory. The preceding sketch of the development of historiography affords striking corroboration of the thesis of Professor Shotwell that the prevailing types of historical interpretation through the ages faithfully reflect the dominating intellectual interests of the successive eras. The divine epics of the ancient Orient were superseded by the mythological and philosophical interpretations of the thinkers of classical antiquity. With the general acceptance of Christianity, the classical mythology was replaced by that eschatological conception which dominated historical interpretation from Augustine to Bossuet. With the coming of the commercial revolution and its violent shock to the old intellectual order, there arose the critical and rationalistic school of Bacon, Descartes, Voltaire and Hume, which, on account of its being too far in advance of the intellectual orientation of the masses, tended to lapse into the idealism of Kant and Fichte and the romanticism of Burke, Bonald, DeMaistre and Hegel. The growth of nationalism following the French Revolution tended to give temporary precedence to the political mode of interpretation, but the great transformations which constituted the industrial revolution, of necessity doomed so superficial a view to an ephemeral existence. The unprecedented breath and depth of modern knowledge and intellectual interests have produced a number of interpretations of historical development, most of which represent the outgrowth of some one of those outstanding intellectual and social transformations which were reviewed above. There are at present some eight definite schools of historical interpretation among the representatives of the modernized students of historical phenomena, each of which has made an important contribution to our knowledge of historical development. They are in no sense in all cases mutually exclusive, but are rather, to a large degree, supplementary. They may be designated as the personal or «great man» theory; the economic or materialistic; the allied geographical or environmental; the spiritual or idealistic; the scientific; the anthropological; the sociological; and the synthetic or "collective psychological." It may be pointed out in passing that, in the main, the older type of historian either clings to the outworn theory of political causation, or, with Professor Emerton, holds that historical development is entirely arbitrary and obeys no ascertainable laws. The best known of these schools of historical interpretation, and the only one that the current political historians accord any consideration, is that which found its most noted representatives in Carlyle and Froude, who claimed that the great personalities of history were the main causative factors in the historical development. This view is, of course, closely allied to the catastrophic interpretation of the 18th century rationalists. Perhaps its most distinguished adherents to-day are Prof. Émile Faguet of Paris and Prof. William A. Dunning of Columbia University. The contributions of the economic school of historical interpretation, which was founded by Feurbach and Marx, and has been carried on by a host of later and less dogmatic writers, such as Sumner, Schmoller, Loria Simons, Ashley, Beard, Bogart and Simkhovitch, are too familiar to call for any additional elaboration. In its best and most generally accepted form, it contends that the prevailing mode and status of the economic processes in society will to a very great degree decide the nature of existing social institutions. In spite of slight exaggerations, no phase of historical interpretation has been more fruitful or epoch-making. Immediately related is the geographical interpretation of history which began with Hippocrates and continued through the writings of Strabo, Vitruvius, Bodin, Montesquieu and Buckle, has been revived and given a more scientific interpretation in the hands of such writers as Karl Ritter, Ratzel, Reclus, Semple, Metchnikoff, Demolins and Huntington. Since the days of Ritter no respectable historian has dared to chronicle the history of a nation without first having acquired a knowledge of its geography. The special phases of this interpretation have been sketched above and need not be repeated at this point. Widely at variance with the economic and geographical interpretation is the somewhat belated offshoot of the idealism of Fichte and Hegel, to be found in the so-called spiritual interpretation of history, which finds its most ardent advocates in Prof. Rudolph Eucken of Germany and Prof. Shailer Matthews of Chicago. Professor Matthews thus defines this view of history: "The spiritual interpretion of history must be found in the discovery of spiritual forces co-operating with geographic and economic to produce a general tendency toward conditions which are truly personal. And these conditions will not be found in generalizations concerning metaphysical entities, but in the activities of worthful men finding self-expression in social relations for the ever more complete subjection of physical nature to human welfare." Viewed in this sense, this type of interpretation can be said to have a considerable affinity with the "great man" theory and apparently aims to reconcile this doctrine with the critical and synthetic interpretation, under cover of a common theological orientation. Closely conformable to this mode of interpretation is Prof. E. D. Adams' attempt to connect the historical development of the United States with a succession of great national ideals, the origins of which are not explained. The attempt to view human progress as directly correlated with the advances in natural science received its first great exposition in the writings of Condorcet and was revived by Comte and Buckle. Aside from the attention given to it by students of the history of science, such as Sarton, Tannery, Libby and Sedgwick, this phase of historical interpretation has been sadly neglected by recent historians, though Prof. F. S. Marvin and Prof. Lynn Thorndike have recently shown its promising potentialities. It has been emphasized incidentally by Professors Lamprecht, Shotwell and Robinson in their synthetic interpretation of history, but it remains the least exploited, and yet, perhaps, the most promising of all the special phases of historical interpretation. Its adherents claim a more fundamental causal importance than can be assigned to the economic interpretation, in that they contend that the prevailing state of scientific knowledge and application will determine the existing modes of economic life and activities. The main tenets of the anthropological interpretation, as well as an enumeration of its chief adherents, have been provided above and may be passed over at this point. The closely related sociological intepretation of history goes back as far as the Arab, Ibn Khaldun; was developed by Vico, Turgot, Ferguson, Condorcet, Comte and Spencer; and has its ablest modern representatives in Professor Giddings of Columbia, Professor Thomas of Chicago and Professor Hobhouse of London. Professor Giddings admirably describes this theory as "an attempt to account for the origin, structure and activities of society by the operation of physical, vital and psychical causes, working together in a process of evolution." As a genetic social science, it works hand in hand with cultural anthropology in the effort to explain the repetitions and uniformities in historical development and to formulate the laws of historical causation. But the latest, most inclusive and most important of all types of historical interpretation, and the one which, perhaps, most perfectly represents the newer history, is the synthetic or "collective psychological." According to this type of historical interpretation no single category of "causes" is sufficient to explain all phases and periods of historical development. Nothing less than the collective psychology of any period can be deemed adequate to determine the historical development of that age, and it is the task of the historian to discover, evaluate and set forth the chief factors which create and shape the collective view of life and determine the nature of the group struggle for existence and improvement. The most eminent leaders of this school of historical interpretation have been Professor Lamprecht of Leipzig; Professors Lévy-Bruhl, Fouillée, Seignobos and Durkheim of Paris; Professor Marvin of London; Professors Robinson and Shotwell of Columbia University, and Professor Veblen of New York. Their general doctrine has gained particular acceptance in France, probably on account of the early and extensive development of social psychology in that country.

Even this brief and hasty review of a few of the more conspicuous innovations in the development of historiography in the last century will convince the reader that the progress in this field has not been less than in the other branches of human knowledge. It will serve to convey the full significance of Frederic Harrison's statement that Freeman's conception of history as exclusively «past politics» ignored nine-tenths of human history. A synthesis of the various modes of approach to the subject-matter of history must be the ideal of all future historians, but the difficulties inherent in this endeavor will make it hard to be attained. An attempt at a synthetic review of the development of civilization has been essayed by Professor Seignobos. A less complete, but a more stimulating and suggestive outline has been supplied by Professor Marvin. An able and original, if not wholly objective, synthesis of the history of the modern world has been supplied by the detailed manual of Professor Hayes. Prof. W. C. Abbott's recent attempt to indicate the significance of the commercial revolution for the development of modern civilization is probably the best harbinger which has appeared of that synthetic tendency which must characterize the «new history.» Professors Robinson and Shotwell have long urged and predicted a larger synthesis of historical material. Whatever success daring individual scholars may achieve in this synthetic movement, it will be apparent that the history of the future must be more and more a co-operative work. The complete mastery of all the newer points of attack will be denied to most individuals and each must contribute through his own speciality. The understanding of this vital fact has contributed more than anything else to a growing spirit of mutual toleration and appreciation among the various «schools» of historians. In much the same way that *the* truth has been replaced by truth in recent years, so *the* history of various enthusiasts has been supplanted by a broader and sounder history. Again, in view of the fact that it has now become apparent that the progress of the human race in a cultural sense since 1500 has been greater than the advancement in 50 or more preceding centuries, the supreme importance of modern history has come to be generally recognized, and the primary attention of the previous generation to mediæval history has become a thing of the past. The earnest labors of the mediævalists cannot be deplored for they have furnished the younger generation of historical scholars with not only a sound methodology, but also with the indispensable background for interpreting the origins of the modern age. Out of the labors of the last half century has come a «new history» which will not only furnish a mental discipline for training in the methods of exact scholarship, but will also enable one to know the past and interpret its significance. As Professor Robinson has said: «The ‘New History’ is escaping from the limitations formerly imposed upon a study of the past. It will come in time consciously to meet our daily needs; it will avail itself of all those discoveries that are being made about mankind by anthropologists, economists, psychologists and sociologists — discoveries which during the last 50 years have served to revolutionize our ideas of the origin, progress and prospects of our race. . . . History must not be regarded as a stationary subject which can only progress by refining its methods and accumulating, criticizing, and assimilating new material, but it is bound to alter its ideals and aims with the general progress of society and the social sciences, and it will ultimately play an infinitely more important rôle in our intellectual life than it has hitherto done.»

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HISTORY, Ancient. In the ordinary use of the word, history is a record of past events and conditions as determined by the processes of investigation included in historical method. The history of mankind treats not so much of individuals as of the progress and decline of communities and states with especial reference to morality, religion, intelligence, social organization, economic condition, refinement and taste, government, and the peaceful and military relations of governments to one another (cf. Andrews, 'Institutes of General History,' p. 3). Strictly there are no periods; the life of mankind flows continuously, never wholly changing the direction of its current at any definite time. But for the convenience of study history is more or less arbitrarily divided into periods, during each of which the resultant of changes in the life of mankind, or of a particular part of it, is supposed to be a determinable movement of progress or decline which the historian takes as characteristic of the period.

The familiar division of general history into ancient, mediæval, and modern may be accepted as the most practical, though it is exceedingly difficult to define these long and complex ages. Most obvious is the geographical characteristic. Leaving out of account India and the farther East, which have contributed little to the progress of the rest of the world, ancient history has to do (1) with the fertile river-valleys adjoining the east end of the Mediterranean; (2) with the Mediterranean basin itself; for the few outlying countries which had a share in ancient history depended upon this area for their civilization. Or taking race and religion as the basis of division, we may define ancient history as the development of pagan, non-Germanic civilization; for with the thorough establishment of Christianity and the coming of the Germans the Middle Age begins. Although ancient history includes many nations and numberless movements of growth and decay, it shows nevertheless remarkable unity. From simple though diverse beginnings the various peoples of the area above defined developed into the one complex political and social organization known as the Roman empire; and when with the wreck of this system the ancient world passed away, there began under new conditions that fresh life of mankind which in its earlier stage we call mediæval and in its more mature growth modern.

History does not concern itself with ultimate origins; it begins with man in the lowest condition in which it actually finds him, and with the help of anthropology, archæology and kindred sciences it traces his improvement from that point upward through the earlier known stages of his existence. For the prehistoric age, which precedes contemporary written records, we are in many cases in a position to ascertain with great distinctness the condition of government, society and culture, although the nature of our sources do not permit us to reconstruct a narrative either of political activities or of personal achievements. Even when the historian reaches the period of contemporary documents and literature, he continues to use all available auxiliary sciences, principally epigraphy, archæology, numismatics, philology and geography. In testing the genuineness and the historical value of sources he makes use of critical principles which are becoming more and more definite and effective with the growth of historical method into a science.

Nowhere has source material accumulated so rapidly in recent years as in the Orient and the region about the Ægean Sea. As a result of continued explorations there our knowledge of human life has been vastly increased, and the beginnings of history have been pushed much farther back into the past. We are now able to study the Egyptians of the paleolithic age (cf. Petrie, 'History of Egypt' (4th ed. i, p. 5 ff), although no date can yet be assigned to that primitive culture, nor have yet been discovered all the links which connect it with the historic age. Beginning with the earliest appearance of written records in the Orient, we may divide ancient history into the following periods. In the chronology of the entire time preceding 1500 B.C. there have been great differences of opinion. This article accepts the system of Eduard Meyer, which has been most widely adopted by scholars.

I. Dawn of Civilization; Political Unification and the Early Centuries of the Old Kingdom of Egypt; the Sumerian Period in Babylonia; the Later Neolithic Age in the Ægean Country, 4000–3000 B.C.—Whether mankind first emerged from the Stone Age in the valley of the Nile or in that of the Tigris and Euphrates rivers has long been disputed, but the evidence now seems to incline decidedly in favor of Egypt. The date of this event, however, has not been closely determined. There can be no doubt that in the fourth millennium B.C. the Egyptians were acquainted with the use of copper tools and weapons. They irrigated their fields, built cities in which they lived under kings, and were acquainted with the elementary practical sciences, such as arithmetic, geometry, surveying and astronomy, as well as with the art of writing (pictographs, hieroglyphs). They had a year of 365 days, which they divided into 12 months.

Gradually the many small principalities along the Nile were united by conquest in a Northern and a Southern kingdom, which were finally joined in one kingdom under Menes about 3300 B.C. The earliest period of united Egypt is designated as the Old Kingdom. Meanwhile tribes of mountaineers, the Sumerians, were invading the lower valley of the Euphrates, evidently from the East. They redeemed these lands from swamps, developed agriculture, created a system of writing (cuneiform), which in time they improved in a phonetic direction, and they discovered the use of copper (Hall, 'Ancient History of the Near East,' p. 30), although for this period no certain written records have been found. They invented also the moon-month calendar and the sexagesimal system of numbers. Briefly, they laid the foundations of Babylonian civilization. As no communication between them and the Egyptians can be discovered, we assume, at least provisionally, that these two peoples made their cultural progress independently of each other. During this period the population of the region about the Ægean Sea were passing through the final millenium of neolithic civilization, best represented in the excavations of Dr. Evans at Cnossus (Hawes, 'Crete the Forerunner of Greece'). The rest of the world was not as yet advanced beyond the neolithic stage.

II. Continuation of the Old Kingdom of Egypt; Early Semitic Migrations into Southwestern Asia; the City-States and the Political Unification of Babylonia; the Early Minoan Age in the Ægean country; the Aeneolithic Age in Italy, 3000–2000 B.C.— In the beginning of this period the capital of Egypt was transferred from Thinis to Memphis, whose Pharaohs of the fourth dynasty (2840–2680 B.C.) constructed as tombs for themselves the great pyramids of Gizeh. For the grandeur and strength of its buildings this age is unique in ancient history. At the same time these immense structures are evidence of a high centralization of power in the hands of the monarchs. A complex system of officials administered the details of governmental business at the capital and in every nook and corner of the kingdom. After the age of the pyramid-builders, however, the central government weakened, and the high officials became feudal lords. It was a period of great economic development, involving a change from copper to bronze. The crafts were highly specialized. Commerce was carried on by river and caravan with the interior of Soudan; a canal was dug which connected the lower Nile with the Red Sea; and royal fleets visited the Phœnician coasts, and occasionally the Ægean islands, for the exchange of products. The people, devoted to agriculture and the industrial arts, were peace-loving, submissive to authority, and intensely religious.

In Asia bands of Semites, issuing from Arabia, overran all Syria. They were the Canaanites of the South, the Amorites of the North, and the Phœnicians along the coast. These larger tribes divided into small city-kingdoms. Phœnician examples are Sidon and Tyre. Their civilization they obtained from Egypt and even more from Babylonia. About the same time other Semites occupied Accad in the Tigris-Euphrates valley north of the Sumerian country (Sumer, Shinar), and Assur (Assyria) still farther north. Independent city-kingdoms prevailed among the Sumerians till they were conquered by Sargon, king of Accad (about 2750 B.C.). He extended his empire to Elam on the East and to the Mediterranean on the West. After that date the forces of centralization and of disintegration alternated till the valley of the two rivers was unified under Hammurabi, an Amorite who had gained control of Babylon (about 2000 B.C.). He is especially famous for his code, the earliest body of written law preserved to our day.

In the Ægean region the Early Minoan culture, including the use of copper, followed after a few centuries by bronze, prevailed. A system of picture-writing was in use. For a long time the culture centred in Melos, which radiated its influence upon the neighboring islands, and even farther, upon the Troad in one direction and upon Bœotia and Argolis in the other; but near the close of the period Crete began to occupy the forefront of progress. The use of copper was introduced into Italy about 2500, probably by way of the Danube.

III. The Middle and New Kingdoms and the Empire of Egypt; Culmination and Decline of Babylonia; Beginnings of the Hebrews; the Middle and Late Minoan Ages; the Bronze Age in Italy and Sicily, 2000–1200 B.C.— In the beginning of the period Thebes supplanted Memphis as the political centre of Egypt. The most brilliant dynasty was the 12th (about 2000–1788 B.C.). The Pharaohs of this family with a firm hand controlled the feudal lords who since the 6th dynasty had been growing strong over all Egypt, and to whom most of the famous rock-graves of the period belong. The same dynasty conquered Ethiopia (Nubia), carried on a lively trade with Syria, and had commerce with countries as far west as Crete. They built splendid temples, and regulated the waters of the lower Nile by means of a great reservoir in the Fayûm. Their utilitarian works contrast strikingly with the grand though selfish idealism of the pyramid-builders.

After the 12th dynasty Egypt again weakened. While she was in this condition, the Hyksos, who seem to have been Semites from Syria, invaded the Nile Valley, and held parts of the country in subjection a hundred years (1680–1580 B.C.). Less civilized than the natives, they brought Egypt to a lower stage of culture, but gradually their king and leading men were assimilated. Their own contribution was the introduction of the horse and the war-chariot, the use of which gradually extended to the remotest parts of Europe. After their liberation from this foreign yoke, the Egyptians became a conquering people. The 18th dynasty (1580–1321 B.C.) built up an empire which extended southward through Nubia and northeastward to the Euphrates River. Cyprus and the "isles of the Great Sea," doubtless the Ægean Islands, sent their gifts, which Pharaoh regarded as tribute.

After Hammurabi, Babylonia suffered from frequent invasions of barbarian tribes. Though her political greatness vanished, her civilization, however impaired by the invasions, continued. In the industries both Egypt and Babylonia had reached a high stage of technical skill. The Egyptians excelled in inlaid work, the Babylonians in the engraving of gems. The architecture was massive, the Babylonian in brick, the Egyptian in stone. The sculpture, too, though lacking grace, showed great strength. The literature was looked upon by after ages as classic. In government we find a centralized monarchy with a bureaucratic administration. In this period the creative energy of the Egyptians had exhausted itself. Life became artificial; wealth, flowing in from conquests, substituted magnificence for taste, and in the end enfeebled the national spirit. On account of the wars the military class came into great prominence; the king, more than before, became the proprietor of the state, and the priests gained control of the material as well as of the spiritual activities of the nation. In Hither Asia, also, artistic and industrial civilization suffered through the decline of Babylonia; for the Assyrian genius was chiefly political and military rather than artistic or intellectual. The family was monogamic, and society was definitely organized in classes. The prime motive power in life was religion, which, manipulated by the priests, was already reducing the activities of man to a system of conventions and thus putting an end to originality.

As the Egyptians lost military power after the 18th dynasty, they were expelled from most of their Asiatic possessions by the Hittites, a people of eastern Asia Minor. They were the first to use iron, obtaining it from the country afterward known as Pontus. In the 13th century we find them supplying Egypt with that metal. Soon afterward their power declined, as they were assailed on the East by the Assyrians, and on the opposite border by many roving tribes from western Asia Minor, from the Ægean Islands, and probably from Europe. One of these peoples from the Minoan area settled on the Mediterranean Coast south of Phœnicia, and are known as the Philistines; others raided the Egyptian Delta (12th century B.C.). Before this date the interior of Syria had come to be occupied by new Semitic tribes from the desert, the Hebrews in the South and the Aramæans about Damascus in the North. Meanwhile there flourished in the Ægean region the Middle Minoan civilization, centering in Cnossus and Phæstus, Crete, and manifesting itself in great palaces, sumptuous dwellings of nobles, a high development of arts, industries and commerce, polychrome pottery of great variety and brilliancy, a linear script as yet undeciphered, and a bureaucratic administration similar to that of Egypt. In most respects this civilization far outshone the Oriental. The Late Minoan period (1600–1200 B.C.) is one of stagnation and decline, in which the centre of political power shifted from Crete to Tiryns and Mycenæ on the Greek Peninsula.

From about 2000 B.C. Indo-European tribes were entering various parts of the civilized world, including Iran and India in Asia and Greece and Italy in Europe. Everywhere they blended with the natives, and usually gave their language to the people resulting from the amalgamation. In the Greek Peninsula the Hellenic or Greek race was thus formed. From the mainland it gradually colonized the islands and the eastern coasts of the Ægean Sea. About 1400 the cities of Crete were devastated, probably by Hellenic and other raiders. Afterward these sites were occupied by far poorer and less civilized villages. The decline of the Minoans through internal decay and barbarian immigrations brought their period to a close about 1200 B.C. In Italy there prevailed the bronze civilization, including the peculiar Terremare settlements in the Po Valley. Sicily and southern Italy were in communication with the Ægean area, whence they received various cultural elements, and probably colonies.

IV. **The Growth and Decline of the Syrian Kingdoms; Rise of the Assyrian Empire; the Greek Middle Age; the Early Iron Age and the Coming of the Etruscans in Italy, 1200–700** B.C.—As the Minoans declined, the Phœnicians succeeded for a time to their commercial position in the Mediterranean. From what has been said it is clear that they were by no means the earliest mariners. At first Sidon was their leading city, but after a time its place was taken by Tyre. The Phœnicians explored the coasts as far as the Pillars of Hercules (Strait of Gibraltar) and even the adjoining Atlantic seaboard, planting along the way trading stations, some of which like Carthage (founded about 800 B.C.) became flourishing cities. Their civilization, with that of all Syria, was fundamentally Babylonian, affected to some extent by Egyptian commerce and conquest. Their alphabet seems to have been derived by a process of selection from the Minoan script, and was the first purely phonetic system. The Greeks adopted it with modifications, probably about 900 B.C.

The Hebrews under their most famous kings, David (about 1000 B.C.) and Solomon, developed a great political power; but after the death of Solomon they split into two kingdoms, Judah and Israel. Damascus, which David had acquired, again became the capital of an independent Aramæan kingdom. Near the end of the period, however, all Syria excepting Tyre fell under the Assyrian yoke. The people of Damascus (about 730 B.C.) and Israel (722 B.C.) were carried into captivity, and Judah became tributary. Babylon, too, was definitely conquered (728 B.C.). Egypt, again declining, divided into many small principalities, while Ethiopia rose to a power of the first importance. Her king conquered the Nile Valley to its mouth in 728 B.C. But the greatest political event of the period was the rise of the Assyrian Empire. Through persistent warfare carried on by a line of able kings for crushing frequent rebellion as well as for new conquests, the empire reached the height of glory, though not yet its widest extent, under Sargon (722–705 B.C.).

Babylonia was crippled for centuries by the invasion of barbarous Chaldeans, who were Semites from Arabia; and it was not till the following period that the reinvigoration, caused by these virile people, prepared the lower Euphrates Valley for a new imperial career.

Meantime great progress was made in civilization. The Hebrews, afflicted by Assyria, were purging themselves of polytheism, and under the lead of inspired prophets were learning to look upon Jehovah as the only God, almighty, pure and jealous, who demanded of his worshippers not only ceremonial exactness but clean hearts and spiritual devotion. With the Assyrians, notwithstanding their strong religious nature, political motives were dominant. For strengthening their empire they adopted the plan (1) of recruiting their armies partly from conquered peoples, (2) of transplanting populations from one part of the empire to another, to break up local attachments and weaken the power of resistance, (3) of organizing some of the conquered countries into provinces ruled by Assyrian officials, though many were still left under their native rulers. In government and administration, accordingly, Assyria was at this time the most progressive of Oriental nations. Efficiency, however, was offset by harshness. The transplanting of populations is always attended by extreme suffering, to which the Assyrians lent a deaf ear. They mercilessly exacted tribute; and suppressed rebellions with horrible cruelty. The records teem with royal boastings of tortures inflicted upon conquered enemies.

In this period the centre of interest in the growth of civilization shifts to the Ægean region, where the Hellenic race was gradually emerging from the union of invading Indo-Europeans with native Minoans. Doubtless the latter had more than the former to bestow upon their common progeny, the historical Greeks, particularly in religion, in law and social organization, and in the elements of industry and art. For a long time life was relatively barbarous, represented by the prevailing geometric art; but in the various excavations, especially those of Sparta, Ephesus and Miletus, we can trace the gradual recovery of civilization. Most progressive were the Æolian and Ionian Greeks who had colonized the eastern coast of the Ægean sea and the neighboring islands. It was they who produced the first European literature — the 'Iliad' (q.v.) and the 'Odyssey' (q.v.). Colonists in a strange country, the Ionians drew their subsistence from grazing, agriculture, and war. With a high degree of refinement, mixed with barbarity, they possessed remarkably virile, elastic minds. In contrast with the slavish Orientals, the Greeks, represented by the Ionians, were in spirit free. To them neither nature nor religion was terrible; their gods were intensely human, generally the helpers, never the implacable enemies of man. Combined with this intellectual liberty and boldness was a rare sense of fitness and proportion, manifested in the Homeric poems referred to above. In Greek manhood, virility, freedom, intelligence and taste combined to produce a civilization which was already rapidly advancing beyond that of the Orient. The Ionians in fact soon surpassed the Phœnicians in navigation and in the arts. It is now well known that many utensils, art objects and decorative patterns formerly ascribed to the Phœnicians belong in truth to the Ionians, who were the chief innovators in a material civilization which centred in the Ægean area and extended through commerce to Etruria in one direction and to the Euphrates in the other. Among the most important constructive agencies in the industrial world was the use of iron, introduced from the Hittite country into Crete in the 13th century B.C., and extended gradually from that island over the Ægean region and to Italy and Sicily. In the 8th century it was known to the Spartans, and probably still earlier to the more progressive people of the coast and islands. Hardened to steel, it added greatly to the efficiency of weapons and of all cutting instruments.

In Italy the Terremare settlements were abandoned (about 1000 B.C.), and the tribes of Indo-Europeans, who had entered the Po Valley a thousand years earlier, began their migrations into the peninsula. As a result the Latins, the Umbrians and the Sabellians took possession of their respective historical countries. Here, as in the Ægean region, with the transition from bronze to iron, civilization fell temporarily to a lower level, from which it gradually rose. The Early Iron (Villanova) Age extended from 1000 to 800 B.C. In this period the famous 'hut urns' make their appearance in Etruria and Latium. Nearly at the latter date occurred the migration of the Etruscans from the Ægean region or its neighborhood into Italy. In culture and in language, which has not yet been deciphered, they bear close resemblances to the decadent Minoans and to the natives of Asia Minor.

V. The Fall of Assyria and the Rise of the Persian Empire; in Greece Colonial Expansion and the Awakening of a National Consciousness; the Struggle Between Asia and Europe, in which Greece Becomes the Centre of Interest in the World's Politics; in the Central Mediterranean Region the Political Growth of Carthage and Etruria; at Rome the Primitive Kingship and the Beginning of the Republic, 700–479 B.C.— Early in the period Lydia became a conquering state, and reached the height of its imperial power under Crœsus (560–546 B.C.), who ruled nearly all Asia Minor west of the Halys River. Egypt fell under the Assyrian power (664 B.C.); but soon throwing off the yoke, it enjoyed a long period of independence (645–525 B.C.). Before the loss of Egypt the Assyrian empire reached from Thebes on the Nile nearly to the Caspian Sea, and from the Persian Gulf nearly to the Black Sea — the greatest extent of country yet united under one ruler. In Nineveh, their new capital, the kings built magnificent palaces of brick, adorned with representations of their wars in sculptured reliefs. They established libraries, too, of Babylonian learning. But they had already ceased to make political progress, and they failed to give their empire an organic unity, and to inspire the conquered nations with loyalty to the central government. Suddenly the empire was overthrown by a combination of the Babylonians and the Medes, who destroyed Nineveh in 606 B.C. With this event Assyria disappeared from history.

Two empires — the Median and the Babylonian — divided between them the Assyrian domain. The former lay in the north of Hither Asia, the latter in the south. Under Nebuchadnezzar (606–562 B.C.) Babylon became the largest and wealthiest city in the world, a brilliant seat of industry and commerce. He destroyed Jerusalem, carried Judah into captivity (586 B.C.), and conquered Tyre. Of the other empire the ruling people were the Medes, an Indo-European people, who inhabited the plateau between the Tigris Valley and the Caspian Sea. Their sway extended westward, on the north of Babylonia, to the Halys River, and southward over their Persian kinsmen. Both empires, however, were short-lived; in 550 B.C. Cyrus, an Elamitic prince, at the head of a Persian revolt, established himself master of the Median realm. This event made the empire Persian. After conquering Lydia (546 B.C.) and Babylon (538 B.C.), Cyrus proceeded to subdue the countries to the east and northeast of Persia; so that at his death (529 B.C.) his empire extended from the Ægean Sea to the Indus River, and from the Persian Gulf to the Jaxartes River — an area perhaps five or six times as great as that of the Assyrian empire. His son and successor, Cambyses, added Egypt (525 B.C.), and Darius, the following king (522–485 B.C.), completing an organization begun by Cyrus, divided the empire into 20 satrapies (provinces), each under a governor termed satrap. This magistrate, appointed by the king, exercised full military and civil authority over his province, subject to royal regulations and commands. Though checked by the continual presence of a royal secretary and by the occasional visits of the king's «eye» (inspector), the satrap enjoyed the splendor and nearly all the power of a sovereign. Darius also built roads throughout the empire, distributed the taxes equitably, and established a system of gold and silver coins. He annexed Thrace to his empire, and made an unsuccessful attempt to conquer Greece.

In the beginning of this period the Greeks were extending the sphere of their influence through colonization. About 750 B.C. they had begun to settle in southern Italy and Sicily; and for two centuries the movement of expansion continued, till their settlements extended from Naucratis, Egypt, to the Pillars of Hercules, and from the northern coast of the Black Sea to Libya. With colonial enterprise the industries and commerce kept full pace. They manufactured armor, artistic bronze-ware, and tastefully painted vases. From Lydia they learned the art of weaving and dyeing fine woolens; from Egypt they derived the elements of astronomy, of surveying, and of the other practical sciences. Great intellectual progress took place; lyric poetry, which flourished in all parts of Greece, shows by its contents that the Greeks were actively thinking on all subjects suggested by their expanding environment. They made a beginning of geography, history and philosophy. Thinking led to religious and moral progress; the Greeks began to exercise self-restraint and moderation in life. Their sympathies widened with their intelligence; they discovered that they were all of one blood, one speech, and one religion, and began to call themselves by the common name of Hellenes. They became aware, too, of the differences between themselves and foreigners, whom they termed «barbarians,» and of their own superiority to all other races. Conflicts with foreigners made the Greeks feel that they ought to combine for mutual defense. In the preceding age (1200–700 B.C.) their whole country was divided among a multitude of small city-states, each under an independent king. While in the more progressive parts of the nation in the period now before us the government was rapidly developing from kingship through aristocracy, oligarchy or timocracy, and tyranny in the direction of democracy, a corresponding movement was going on toward political unity. The city of Sparta, after uniting by conquest Laconia, Messenia, and Cynuria in the strong military state of Lacedæmon, built up the Peloponnesian league with herself as leader. The basis of her superior military organization was the phalanx. Under the fear of Persian invasion this power expanded into an Hellenic league of all the loyal Greek states on the peninsula and on the neighboring islands. In Sicily a similar league grew up under Syracuse for defense against two formidable powers, Etruria and Carthage. The Etruscan dominion extended from the Alps to the vicinity of the present Naples, and probably included the then insignificant city of Rome, which after having been ruled from the earliest times by kings set up a republic in 509 B.C. The Etruscans, now at the height of their development, were equally powerful by land and sea. Even more formidable to the Greeks was Carthage, the greatest Phœnician colony, which united under its leadership all the other Phœnician settlements in the western Mediterranean region. By means of enormous wealth accumulated through commerce, this city recruited a vast army of mercenaries, with which she hoped to overwhelm the western Greeks.

Checked by the growth of foreign powers, Greek colonial expansion came to an end about 550 B.C. Then the boundary of free Hellas on the east was pushed back by the Lydian and Persian conquests in Asia Minor. A revolt of the Ionians against Darius,— in which the insurgents were aided by the mother country,— precipitated between Asia and Europe a conflict destined to affect the whole future history of the world. An army sent into Greece by Darius, was beaten back by the Athenians at Marathon in 490 B.C. Ten years afterward, Xerxes, son and successor of Darius, led a vast host into Greece, hoping to overwhelm the free little country by the sheer force of numbers. But his fleet was shattered in the battle of Salamis (480 B.C.) and his army destroyed at Platæa by the forces of the Hellenic league (479 B.C.). Meantime at Himera, Sicily, the despot of Syracuse destroyed the invading mercenary army of Carthage (480 B.C.). The Greeks met with brilliant success both in the East and in the West: those of their race in Asia Minor were liberated; all were relieved from fear of foreigners; Greek civilization was free to develop without the restraint of alien rule; Greece came out of the struggle strong, proud, self-conscious, ready for great achievements in peace and in war.

VI. **The Culmination and Decline of Greek Political Power and of Greek Civilization; the Hellenization of the Orient; the Unification of Italy Under Rome, 479–264 B.C.**— The splendid naval force which Athens furnished for the war, together with superior statesmanship, placed her at the head of a new league of maritime Greek states, known as the Delian Confederacy (organized 477 B.C.). Rivalry for the headship of Greece between democratic Athens and oligarchic Sparta led to the Peloponnesian War, which involved a great part of the Greek world (431–404 B.C.), and which ended in the establishment of Spartan supremacy (404–371 B.C.) over eastern Greece, while nearly all western Greece was united under Syracuse. Oppression on the one hand, and on the other the love of the Greeks for city-autonomy, caused the downfall of both political powers. For a short time under Epaminondas (371–362 B.C.). Thebes attempted to take the place of Sparta, but in vain; the Greek state-system,— consisting of leagues and hegemonies of cities,— was rapidly crumbling. Meanwhile Macedon, a territorial state under King Philip, taking advantage of the political disunion and mutual jealousies of the city republics, began to encroach on free Hellas. After defeating the combined forces of Athens and Thebes at Chæronea (338 B.C.) he imposed his protectorate upon the Hellenic state-system. His son Alexander the Great in a series of brilliant campaigns (334–331 B.C.) conquered the Persian Empire, and afterward extended its boundaries to the northeast and the east. His empire was the largest the world had known. Among his improvements was the specialization of administrative functions, financial, judicial and military. When he died, the empire after a long struggle among his generals ultimately divided into three great states,— Egypt, Asia (the Seleucid Empire) and Macedon, including Greece. To regain and preserve their liberty many of the cities of eastern Greece entered into two federal unions, the Ætolian and the Achæan. These institutions, though long known to the Greeks, came into favor too late to save them from the domination — not of Macedon but of Rome. The western Greeks, however, were first to meet their fate.

After adopting a Republican constitution Rome engaged with her neighbors in a long, desperate struggle for existence (509–431 B.C.). Then by securing the headship of Latium (431–406 B.C.) and by the conquest of Veii she became one of the strongest powers in Italy. A series of wars with the Latins, Samnites and Italiot Greeks (343–290 B.C.) gave her control of all Italy south of the Rubicon River. The success of the Romans was due to their improvement on the Greek phalanx, their strict discipline and obedience to authority, their laborious patience in fortifying acquired territory and their liberality in the treatment of conquered peoples. The political system which in this period they gradually built up on the basis of Italian nationality recognized various gradations of rights and obligations among the communities of the system from the tributary subjection of the Gauls to the full Roman citizenship. Though partly federal, the system left to Rome absolute control of foreign and military affairs. At the close of the period (264 B.C.) Rome and Carthage were the great powers of the western Mediterranean; those of the East were Macedon, Egypt and the Seleucid Empire.

The century and a half (479–322 B.C.) following the Græco-Persian War was in some respects the most brilliant in the history of civilization. The tremendous energy roused in Greece by the war displayed itself under the guidance of taste and reason in every field of activity. A wave of independence, overthrowing tyrannies and oligarchies, established popular governments in many cities, and intensified the democracies already existing. In Periclean

Athens, which depended economically upon the labor of slaves and tributes from dependent allies, the citizens enjoyed a more liberal education and a wider range of political and social privileges than have ever fallen to any other community known to history. In close relation with this political and social development architecture, sculpture and literature reached ideal perfection. The 5th century produced the Attic drama (Æschylus, Sophocles, Euripides and Aristophanes), the noblest historical writing (Herodotus and Thucydides), and the inimitable Parthenon and Erechtheum. But the Peloponnesian War exhausted the energy and resources of eastern Greece. The growing refinement and love of peace which characterized the following century is indicated by the fact that the inhabitants of the city-states shirked military service, so that war came largely into the hands of mercenaries drawn from the less cultured territorial states. Thought prevailed over action; and in art strength was to some extent sacrificed to beauty and finish. While poetry declined, oratory and philosophy reached the height of their development in Demosthenes, Plato and Aristotle, who brought classic Greek literature to a close.

Following the conquests of Alexander, commerce, colonization and administrative policy spread Hellenic civilization over the Orient. In the post-classic period (after 322 B.C.) Pergamum and Alexandria became the most famous seats of Hellenistic culture, which was distinguished for painstaking scholarship rather than for creative power. The West, too, was falling under Hellenic influence. Rome adopted from the Greeks not only the phalanx, but also various deities and religious ideas, the alphabet,— either directly or through the Etruscans, — and other rudiments of civilization. From the Etruscans chiefly came the impetus to the building of public works,— temples, sewers, roads, bridges, fortifications,— in which the Romans showed creative genius. But to the end of the period they paid little attention to learning; they were without literature and had few if any schools. A realistic, practical people, they were narrow and unamiable in private and business relations, but excellent warriors and citizens. Duty and Discipline were the great commandments to which the family and society, citizens and soldiers, yielded religious obedience. These heroic virtues were not the least important factor in the creation of their empire.

VII. **The Expansion of the Roman Power over the Mediterranean World; the Growth of Plutocracy and the Decline of the Republic, 264–227** B.C.— The extension of the power of Rome over the peninsula brought her into collision with Carthage, which had occupied nearly the whole of Sicily and was now threatening southern Italy. Not only did Rome feel bound to protect Italy, but her growing commercial class desired by conquest to extend its opportunities for trade and speculation. The First Punic War (264–241 B.C.) may be compared in character and importance with the war between the United States and Spain, which resulted in the occupation of the Philippine Islands by the former power. To meet the Carthaginians on their own element, Rome built a navy, and thus equipped herself for transmarine conquests. As a result of the war, Carthage surrendered Sicily to Rome in addition to paying a heavy indemnity. This island became the first Roman province (227 B.C.). Sardinia and Corsica, acquired soon after the war, were organized into a second province. Then by conquering the Gauls in the north of Italy (225–222 B.C.) the Romans extended their sway to the Alps. In the Second Punic War (218–201 B.C.) the Carthaginian Hannibal, one of the most eminent generals of all time, invaded Italy, defeated one Roman army after another, desolated the country and came near wrecking the power of Rome. Her preservation was due to the wisdom of the Senate, to the solidity of Roman character and to the tie of common interests and of kindred blood which bound the Italians together against the alien intruder. This war of defense shows Rome at her best. Peace brought her two provinces in Spain and the destruction of her rival's navy. So greatly superior was now her strength that the conquest of the civilized world had become merely a question of a few years. In another series of successful wars (200–146 B.C.) she acquired Macedon, Greece, Asia Minor and the country about Carthage. Corinth and Carthage were destroyed, and most of the acquired territory was organized into provinces. At this date (146 B.C.) Rome was the only great power in the entire Mediterranean basin. The further growth of her empire consisted mainly in the conversion of protected and dependent countries into provinces and an occasional conquest. To Pompey belongs the subjugation of Syria (65–62 B.C.), which alone remained of the Seleucid Empire, and to Julius Cæsar the more important conquest of Gaul (58–50 B.C.). Egypt, long dependent, became a province in 30 B.C. The Roman Empire, consisting of provinces and dependent allies, now included the whole circuit of the Mediterranean.

Some advantages came to the world from Roman rule: while in the East Græco-Oriental culture continued undisturbed, Latin civilization, which was falling more and more under Hellenic influence, gradually permeated the provinces of the West; throughout the empire the cities retained their own laws and self-administration under the government of their wealthy class; all parts but the frontiers enjoyed lasting peace. The evil effects of the system, however, soon began to outweigh its advantages. To secure a monoply of commerce for themselves, the Romans restricted trade among the subject communities. Over all the empire they acquired vast estates, which they worked by slave labor, thus destroying everywhere the free peasantry. Their policy of farming the taxes was also unjust and oppressive. The governors, too, with rare exceptions made office a means of amassing fortunes. In these ways the administrative and capitalist classes recklessly exploited the provinces for their own profit. At the same time commercial restrictions and the competition of slave labor were ruining the farmers and business men of Italy, and a worthless, dangerous mob was growing up in the capital.

The early government of Rome by magistrates, Senate and assemblies, although admirably adapted to a small community, proved unequal to its new and complex functions. The assemblies, now becoming corrupt, were in the hands of magistrates, ministers of the Senate, which as a whole was controlled by a small knot of members, the curule ex-magistrates. This inner circle formed in the beginning a nobility of merit; it saved the state from Hannibal and conquered the Mediterranean world. But it soon transformed itself into an hereditary caste, which, monopolizing the domestic and imperial offices, used them as a means of absorbing the wealth of the world. In brief the nobility degenerated into a corrupt, self-seeking plutocracy. As to the general condition of the world at this time it should be noted that the want of competition, such as exists among nations of approximately equal power, or stated positively, the monopolistic greed of Rome, by reducing the vitality of mankind, stopped progress, and decay was already setting in. Thorough reform was needed even to postpone the collapse of ancient civilization.

The Gracchi sacrificed their lives in a vain attempt to regenerate the peasantry and to restore Italy to its old condition of economic health; at the same time they showed the enormous power of the plebeian tribunate for purposes of reform or revolution. Far preferable to government by the corrupt aristocracy or by the mob, which Gaius Gracchus organized, would be the strong rule of one man; and the task of creating in the army a solid foundation for a government of the kind was accomplished by Gaius Marius. After him the governor (proconsul) of a military province employed his position as a means of acquiring an army for political use; and the proconsuls became rivals for the mastery of Rome. Finally Gaius Julius Cæsar, an aristocrat by birth but a champion of the people, allying himself with the tribunes, overthrew the republic and created a virtual monarchy. This great statesman planned many radical reforms, including the abolition of the pernicious system of tax-farming, the reorganization of the municipalities and the subjection of the provincial governors to a stricter supervision. His enemies, however, did not permit him to live long enough to carry out his reforms; and it is in fact doubtful whether the absolute monarchy which he planned would have proved a blessing. The assassination of the monarch, far from restoring the republic, was followed by a war of succession, in which his grand-nephew Octavius — after 27 B.C. Augustus — won the imperial prize (31 B.C.).

VIII. The Empire at Its Height, 27 B.C.— 180 A.D.— Instead of recurring to the autocracy of Cæsar, Augustus hit upon a compromise between republic and monarchy (27 B.C.). The Senate through its magistrates and promagistrates was still to govern Rome, Italy and the peaceful provinces, while Augustus as holder of the military authority (*imperator*, hence emperor) was to rule directly the exposed and unquiet provinces and to exercise supervision even over those administered by the Senate; the republic was to continue for Italy, the monarchy was established for the subject countries. In Rome, Augustus held the tribunician power, and was sometimes elected to republican offices; but his chief influence over the home government was exercised not through office but in the capacity of political «boss,»— a position which the Romans dignified with the name of *princeps* (foremost citizen). The prince and the Senate had not only their separate fields of administration but also separate treasuries and separate sets of officials. Augustus and his successor, Tiberius, strove to maintain what was left of the republic; the Claudian and Flavian princes, by gradual encroachment on the senatorial prerogatives, aimed to convert the principate into a monarchy. As the Senate declined, the officials of the prince, originally his friends and household servants, developed into an imperial bureaucracy. After the tyranny of Domitian the «Good Emperors» (96–180 A.D.), in reconciling the nobility to the principate, laid more firmly the constitutional basis of their power. The government may now be termed a monarchy, although the Senate, with its republican traditions, continued to be a material check upon the powers of the prince.

The emperors made few permanent conquests,— chiefly Britain and the Danubian provinces. Their fundamental task was to extend Latin civilization to the un-Hellenized parts of their dominion. In Africa west of Egypt, notwithstanding the survival of the Phœnician language in private life, Latin civilization took deep root. Spain and southern Gaul became perhaps even more thoroughly Latinized. Northern Gaul was less affected, and Britain still less, by the Romans, while the northern provinces east of Gaul varied greatly in their receptivity of Latin culture. The principal factor in the work of civilization was the city; in most of their European domains the Romans superseded the old tribal organization by the Italian municipal system, which gave the nations the refining and disciplining influence of comfortable homes, useful and artistic public works, schools, courts of justice and local self-government. Each city was a centre from which Latin modes of life and Latin ideas radiated. Imperial rule cured most of the ills of republican administration. Abolishing the farming of direct taxes, it placed their collection in the hands of imperial officials, and distributed them on the basis of a careful census. The governors, now drawing their salaries from Rome, and deprived of their former unlimited opportunity for extortion, were held responsible to the emperor. The armies, placed under strict discipline and controlled by one will, no longer wasted the empire by civil wars. For the vast extent of the frontier the soldiers were few, and the burden of their support was light. The republic had looked upon the provinces as its estates; in the 2d century A.D. the emperor came to regard himself as the parent of the subject peoples, whom he was in duty bound to treat with love as well as with justice. Though oppression was not wholly eradicated, the imperial government was in a high degree efficient, just and humane. The progress of civilization was followed by the extension of the Roman citizenship. The liberal policy of Claudius in bestowing it was continued by his successors, till shortly after the period under discussion all freemen of good standing in the empire became Romans by the edict of Caracalla (212 A.D.)

In this period was tried the experiment of maintaining profound and lasting peace over the large area comprising the interior provinces. Prominent among the results was a material prosperity which had at least the appearance of being very great. Another result was the development of the «feminine virtues.» Men «became chaste, tender-hearted, loyal, religious, capable of infinite endurance in a good cause» (Seeley, 'Roman Imperialism'). They began to regard women as their equals, to treat children and slaves humanely, to show kindness even to animals, and in spite of gladiatorial contests, to abhor bloodshed. Morals, at their lowest ebb in the Rome of Nero, were rapidly purified by the coming in of the best families from the provinces, so that under the Good Emperors morality in the capital reached a high level. The spirit of the age expressed itself not only in the private and social virtues, but also in the Civil Law, which rested upon the principles of justice, kindliness and equality among men.

The unimaginative Romans failed to produce a literature of the highest rank. In the late republic lived Lucretius, a poet of real genius, and Cicero, the versatile author of orations, philosophic works and private correspondence. The Augustan Age created the epic and rural poetry of Virgil, the 'Odes' and 'Satires' of Horace on social and moral topics, and Livy's stately history of the republic. The most splendid Latin writers of the age of the Good Emperors were the satirist Juvenal and Tacitus, the historian of the early empire. Among the most famous writers in the Greek language in the first two centuries A.D. were Strabo the geographer, Pausanias, author of a 'Tour of Greece,' Appian, the historian, and Plutarch, the biographer of eminent men. Hellenism continued to be the chief liberalizing and refining force in the empire. Its highest intellectual product from Roman soil was stoicism, which found its best expression in the writings and character of Marcus Aurelius.

IX. **From Limited Monarchy to Despotism; the Reorganization of Diocletian and Constantine; the Barbarian Invasions and the Decline of the Empire, 180–500** A.D.— Writers generally agree in making the decline begin with the reign of Commodus (180–192 A.D.), though disintegrating forces had long been in operation and though for generations afterward the empire at times, as under Septimius Severus and Diocletian, showed great recuperative power. The century which intervened between the death of Marcus Aurelius and the accession of Diocletian (180–284 A.D.) we may regard as a period of revolution. The happiness of the Roman world under the Good Emperors had been chiefly due to the wisdom of a succession of rulers who were able to secure the good will of the Senate and of the populace of Rome, the subordination of the pretorians and of the army and the respect of surrounding nations. The weak, brutish Commodus allowed these nicely adjusted forces to conflict, and the result was civil war and anarchy. The revolution, sweeping away the influence of pretorians, populace and Senate, almost of Rome itself, brought new principles of government into play. The emperor was to be a despot of the Oriental type,—a God on earth,—who surrounded himself with stately splendor, and governed through a complex bureaucracy. He appointed a colleague, and two Cæsars were named as heirs of the emperors, all four dignitaries being men of eminent military ability. The empire was reorganized in prefectures, dioceses and provinces under appropriate magistrates. These arrangements, chiefly the work of Diocletian (284–305 A.D.), and Constantine (sole emperor 324–337 A.D.), were in the main permanent. In making better use of the resources of the empire for the purposes of defense the new organization brought fresh strength, but rivalry between the emperors again caused civil wars with all their evil consequences. Under Constantine, who removed the capital to Byzantium, thereafter called Constantinople, the two imperial offices were again vested in one person. After that date there were often two or more emperors; and the division of the empire into East and West for administrative purposes acquired a new sanction at the accession of Arcadius and Honorius, sons of Theodosius (395 A.D.). Even then the empire was a unit, ruled by two colleagues; and when in 476 A.D. Romulus «Augustulus» was deposed at Rome and the imperial trappings were sent to Constantinople, people understood merely that the collegial government had once more given way to unity in the imperial office.

Meanwhile from the heart outward through every limb the empire was falling to decay. The most obvious cause was economic. Judged by any modern standard, the empire as a whole was poor. It is true that parts of it, especially in the Orient, were wealthy; but throughout the West were vast undeveloped regions, whose administration and protection formed a perpetual burden on the imperial treasury. The emperors made heroic efforts to improve these territories; but in doing this they exhausted the productive areas. With modern means their task would have been simple; but there were practically no machines in Roman times. Consequently everything had to be done by hand; and under the circumstances it was impossible to produce enough useful materials to make good shortages in the less developed parts of the empire and those losses that were caused by drought and pestilence, in addition to providing the necessities of life for the armies, the hosts of officials and the idle poor in all the cities. In other words, the industries were not sufficiently developed for the maintenance of so vast an empire.

Another cause was the excessive concentration of the people into cities, where the lack of sanitary arrangements, such as now exist, brought about an enormous mortality, where too the relatively high standard of living and the want of remunerative occupations discouraged the rearing of families. Hence the city population had continually to be recruited from the country; and when the rural districts came to be sparsely inhabited, the consequent disappearance of the cities was accompanied by the wreck of ancient civilization. Among the contributory causes was slavery, which long before Marcus Aurelius had been destroying the free population; in his time the plague, and after him foreign and civil wars, continued to waste life, while the burden of taxation, always increasing, made life every day more wretched. The wealth of the empire flowed to the East in exchange for useless luxuries; and for want of gold and silver the coinage was debased; at the same time the cost of living became excessive. Then, too, the growing splendor of the imperial courts added to the burden. With their scant means many found it impossible to support families, and even the slaves grew fewer. In these conditions most of the lower population, free and slave, became hereditary serfs — *coloni* — bound to the soil and to the payment of fixed dues to their lords. But it was not only the poor who suffered. The municipalities had once enjoyed freedom in local affairs, each governed by a senate, whose members — *decuriones* — were the wealthier men of the community. Gradually the emperors encroached upon the liberty of these cities, till they had converted even the privileges of the senators into intolerable burdens. For as these officials were responsible for the taxes due from their districts, many of them, unable to wring the required amount from the poorer classes, were themselves reduced to poverty. Nevertheless they could in no way shirk their duty, but were held for life by an iron hand to the unenviable task of collecting and of paying oppressive taxes. Artisans and traders, too, were bound strictly to their hereditary vocations, in order that the government might be sure of the dues to which they were subject. In brief, society was forced into a rigid caste-like system, which crushed freedom and made the life of rich and poor, bond and free, almost equally wretched. Under these circumstances, and after ages of governmental brow-beating, the inhabitants of the empire lost their interest in the welfare of the state, of the community, of future generations. As the civilized part of the human race lost love of life and hope for the future, it began rapidly to die out, and those who still lived grew continually more barbarous. As they were unwarlike, the government found it more and more necessary to make up the armies of Germans, who consequently settled in the empire in ever-increasing numbers. Although they readily adopted Roman civilization, their independent spirit, out of harmony with the conditions above described, acted as a new distintegrating force. Another power, which while aiming to make the world over on its own model tended to destroy ancient ideas and institutions,— including the empire itself,— was Christianity. Rome, essentially polytheistic, always tolerated the religions of the nations which she conquered; in the adoption of their gods into her pantheon she found a means of political centralization. Judaism, however, she regarded with disfavor, and attempted to suppress Christianity. These exceptions to her policy of toleration were due to the irreconcilable conflict between monotheism and polytheism and to the leveling tendency of the Christian religion. The apostles of Christ taught that the gods of Rome were demons, that the worship of the emperor was sinful, that all men from the emperor to the slave were equal before God, that the heaping up of wealth was an abomination; in brief their religion seemed to the Romans subversive of all the principles on which the empire rested. But although Christianity and Germanism were disintegrating the empire, they were destined in combination to make the old world new. The estimate of their value as creative agencies belongs to the mediæval period.

In appearance more formidable than internal decay were the hostile nations outside the empire. In the 3d century the Germans, who had long been threatening, began to break through the northern frontier. The Franks flung themselves upon Gaul; the Goths occupied Dacia and crossed the Danube to defeat and kill an emperor. In the East, too, a new danger appeared; on the ruins of the old Seleucid power had arisen in the Parthian Empire, which in the 3d century was supplanted by a new, vigorous Persian Empire. The warlike Persian monarchs nearly made good their threat to drive the Romans from Asia.

Early in the 5th century the Germans began to establish their states within the empire — the Visigothic kingdom in Gaul and Spain (415 A.D.), that of the Vandals in Africa and of the Burgundians in the Rhone Valley. About the middle of the century the Angles and Saxons began to overrun Britain; a little later the Franks, who long before had crossed the Rhine, began the conquest of Gaul (486 A.D.); and in 493 A.D. the Ostrogoths conquered Italy. Before the end of the century the western branch of the empire had fallen into the hands of Germanic chiefs, who while vaguely recognizing the emperor at Constantinople as their lord were in reality sovereign kings of the countries they ruled. Here ancient history ends.

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HISTORY, Mediæval. Definition.— Mediæval history may be defined as the middle period between ancient and modern history. Some scholars have wished to do away with the term entirely and to use only two divisions, ancient and modern. In fact, in Oriental history there is no mediæval period. But most students prefer to keep to the threefold division for European history. This is due largely to the fact that the mediæval period can be presented with greater unity than either ancient or modern.

Mediæval history began with the disintegration of the Roman Empire in the 5th century, the ruin of Paganism and the migrations. Without arguing the merits of the various dates which may be assigned for the end of the Middle Ages (q.v.), we shall here discuss the history to about 1500 A.D. During this period of 1,000 years, the most marked characteristic is the dominant influence of the Church. The most important peoples are the Germanic races, who emerged slowly from barbarism, and gradually assimilated some of the features of the Roman civilization. Based upon the ruins of the older rose a new civilization which caused a radical transformation in political, social and religious ideals.

Contrast Between Romans and Germans. — The Romans had a highly developed and very complex civilization. From their Greek subjects, they had acquired the knowledge of art, literature, science and philosophy. Under the Roman peace, an active commerce had grown up throughout the empire, supplying to each province the products of all the others. In law and administration the Romans had reached such excellence that we still imitate them. Moreover, Christianity had become the state religion.

The Germans were barbarians, having the virtues and vices of their savage state, and resembling, in many respects, the North American Indians. But they were a vigorous race, with a great capacity for learning. Some of them had been converted to Christianity before they entered the Roman Empire, but most of them were still pagans.

Migrations.— The Roman Empire had for centuries held the barbarians in check, by the prestige of its name, by the payment of tribute or by the policy of exciting dissension among its enemies. This last is well summed up in the Roman proverb, *Divide et impera*, which may be paraphrased, "Cause divisions and strife among those whom you fear and thus rule over them." In the latter part of the 4th century, however, the terrors inspired by the advance of the Huns (q.v.) into Europe, the knowledge of the weakness of the Roman Empire and their own desire for more fertile lands, caused the Visigoths (q.v.) to enter upon their great migration. Their example was followed by other German tribes and the movement continued throughout the 5th and 6th centuries. By the year 600 all the European portion of the Western Empire, except a few positions in Italy, was held by the Germans.

During the period of the migrations there was some destruction of life and property, but the amount of the damage varied; it was great in northern Africa and Britain; slight in Gaul. And nowhere were the conquered inhabitants either exterminated or driven out. The German invaders were relatively few in number, and in many sections they found unoccupied lands sufficient for their needs. The conquerors and the conquered lived in constant contact with one another, and the resultant civilization was partly Roman and partly German. See MIGRATIONS.

Fusion of the Two Civilizations.— The 7th and 8th centuries were the period of fusion. By the year 800 the terms *Roman* and *Barbarian* were no longer used. The inhabitants formed a single people, with a civilization much lower than the Roman but much higher than that of the Germans when the latter had entered the empire. In this new composite civilization the Roman influence was greater in language, mechanical arts, business arrangements and municipal, intellectual and ecclesiastical affairs. The German influence was greater in military matters and judicial procedure.

The fusion was practically completed by the time of Charles the Great. He realized clearly the task of the Middle Ages, and did all in his power, on the one hand to retain all that was best of the older German customs, and, on the other hand, to introduce from Italy such Roman customs as his subjects were able to adopt. He did much to foster education, which followed Roman models. By his wars, he brought under his sword most of the German peoples.

The New Empire.— In 800, Charles' services received fitting recognition in his election as emperor of the Roman Empire. The idea of a Roman empire which embraced all Christians had never been lost. After 476, when Romulus Augustulus was deposed, by Odoacer, the people in the West, Germans and Romans alike, had regarded the emperor at Constantinople as the head of the Christian world. Even barbarians like Clovis (q.v.) had been proud to secure recognition and obtain a title from the emperor. The popes had looked to the emperors for support. In the last years of the 8th century the East was ruled over by Irene (q.v.), who was despised both because she was a woman and for her crimes and heresy, so that it seemed to many that the imperial office was vacant. Consequently, Charles was crowned emperor and was considered the successor of Augustus, Trajan and Constantine. Under his strong rule the Western world was governed firmly and the Western nations were held together.

Disintegration of the Empire.—After Charles' death, his son was unequal to the task of ruling the empire. Under the combined effects of civil strife and constant invasions by the Northmen, the Mohammedans and the Slavs (qq.v.), the central power was weakened and the last Carolingian rulers were unable to protect their subjects. The whole frontier was exposed to attacks and the raids of the enemy even extended far into the interior. In each district the strongest man came to be regarded as the natural leader and protector. Sometimes it was a royal official, holding a fortification; sometimes it was an abbot or a bishop; at other times, a bold adventurer, who usurped authority. In the absence of a strong central government, each leader had to police his land and administer justice. Naturally, he demanded to be paid for his services and exacted tribute from all under his control.

Because of the lack of money, the Carolingians (see CARLOVINGIANS) had always furnished to their counts and other officials estates from which to obtain a living. Under the weak kings, the temporary grants of both land and office became hereditary, with or without the rulers' consent. The rulers, however, soon recognized the necessity of allowing this and sought merely the recognition of their own overlordship. Consequently, they granted the benefices to the heirs and conferred, in addition, the immunity or right of independent jurisdiction. Thus almost all land and power came to be held feudally. See FEUDALISM.

Feudal Anarchy.— There was constant warfare as each strong lord sought to obtain greater power or a more independent position. On the other hand, each king tried to increase his own feudal holdings by conquest or marriage. Every vassal was anxious to avoid all the feudal services that he could, and, at the same time, to exact as much as possible from the people subject to him. Commerce was burdened with excessive tolls in each fief and exposed to the depredations of the robber barons. Little attention was paid to maintaining roads and bridges, consequently travel was difficult as well as dangerous. As a whole, the feudal régime tended to isolate each fief and to reduce the peasantry to misery. It is significant that the term «Dark Ages,» formerly applied to the whole of the Middle Ages, is often used now for the 9th and 10th centuries.

The Church.— The great cohesive and educational force was the Church. Soon after they entered the Roman Empire, each tribe of Germans had been converted to Christianity; all except the Franks (q.v.) became Arians (q.v.) at first, but gradually this heresy was abandoned. In every barbarian kingdom the bishops were important officials. They often obtained great wealth, and ruled over vast estates. On their possessions, the serfs were treated somewhat better than on the lay fiefs. Monasteries had been founded throughout western Europe, and often these served both as schools and as model farms. Boniface did much to bring the tribes of Germany into direct connection with Rome, and he held frequent Church councils at which the clergy and nobles of a whole district came together. These councils were very important for their effect in unifying the Church and making its work more effective.

From this time the Church gained steadily in power and influence. Charles the Great did much to increase its wealth by enforcing the payment of tithes. He insisted that the clergy should be better educated themselves and should do more for the education of the people. In the 9th century the growing power of the papacy and the weakness of the kings enabled the popes to bring the bishops more directly under their own control. Thus the clergy of western Christendom were brought into intimate association with Rome. Latin was the common language of all churchmen. Their feeling of membership in the Church was frequently stronger than any local attachment. Consequently the more able men were equally at home in every country and the Church had a greater unity than any lay power. This all-pervasive Church was the great unifying element amid the divisions of the feudal period.

Investiture Struggle.—After periods of weakness in the first half of the 10th and again in the first half of the 11th century, the Church at Rome was purified and strengthened by the support of the German emperors. About the middle of the 11th century, the strong personalties of Pope Leo IX (q.v.) and of Hildebrand (later Gregory VII) (q.v.) led to a reform movement, and also to an effort to make the popes' power more effective. One feature of this movement was an attempt to secure entire control of appointment to church offices. This brought the papacy into conflict with the kings who considered that they had a right to nominate the bishops in their own kingdoms. The struggle was most acute between the German emperors and the popes, and resulted in the long investiture conflict, which was ended in 1122 by a compromise. See INVESTITURE.

Roman Empire of the German Nation.—But the investiture struggle was only a single phase in the relations between the empire and the papacy (q.v.). In order to understand this it is necessary to study the fortunes of the empire after Charles the Great. Under his successors, the emperors had gradually lost their power, so that by the end of the 9th century, the title of *emperor* had become almost a meaningless designation, either conferred by a Pope on anyone of whom he wished to make use, or else usurped by any ruler who chanced to be temporarily the strongest personality in Italian affairs. This continued to be the fate of the imperial title until Otto the Great (q.v.) was summoned to Italy, because of the discord and anarchy in the peninsula. In 963 he was crowned emperor, and became the ruler of both Germany and Italy. Under his son and grandson, Otto II and Otto III, "the Roman Empire of the German nation" was a very effective power in controlling both the imperial lands and the papal policy. After the death of Otto III in 1002, the German rulers paid little attention to Italian affairs until 1046, when Henry III was summoned to Rome because of the contest which was being waged between three rivals for the papal office. For 10 years he wielded a power similar to that of the Ottos. But at his death, as the heir was a young child, the reformed and strengthened papacy was able to assert its independence. When Henry reached manhood and desired to regain his father's power, the contest began and took the shape of the already mentioned investiture struggle. After the Concordat of Worms (q.v.) there was little conflict until the accession of Frederick Barbarossa (q.v.), who was determined to be emperor in fact as well as in name.

Empire and Papacy.— On the other hand, the papacy was strong and was determined to assert its paramount authority. There ensued a struggle of 100 years between the Hohenstaufen emperors and the popes. In spite of the ability of the rulers and the brilliancy of their reigns, the popes triumphed, largely by means of the assistance of the Lombard cities, which had grown rich and powerful and aimed to be independent of the imperial control. The death of Frederick II in 1250 really marks the end of the mediæval empire as a strong international power, although it continued, under a changed form, to be a factor in European politics for centuries longer, and came to a close only in the 19th century.

The Crusades.— The increasing power of the popes was also marked by their desire to extend their authority over the Eastern Church as well as the Western. This was in part the cause of the Crusades, which were the most important manifestation of the strength and influence of the Church. The spirit of asceticism (q.v.) had long been inculcated as the most distinguishing mark of Christianity. The consciousness of their own sins and the teachings of the Church led many to do penance. One of the favorite forms, especially for heinous crimes, was a pilgrimage to some hallowed spot. The most difficult pilgrimage and the one to which greatest sanctity attached was the journey to Jerusalem. In the 11th century, 116 separate pilgrimages to Jerusalem are recorded, and, in some of these expeditions, hundreds and even thousands took part. Thus attention was directed to the Holy Land. Moreover, in spite of the disorders of the feudal régime, the population was increasing, especially in France. The people were hard-pressed to get food, and were anxious for a change of any kind. Consequently, when the Emperor Alexius appealed for aid and Pope Urban II preached the crusade at Clermont thousands took the cross. The movement spread rapidly and affected every country in Europe. Although Jerusalem was in the possession of the Christians for little more than a hundred years, the crusades to the Holy Land, which continued for 200 years, produced great results. In order to understand these, it is necessary now to take up the Byzantine and Moslem civilizations. See CRUSADES.

Byzantine Civilization.— Until 60 years ago, Byzantine history was misunderstood. It was looked upon as the long death struggle of a society in which all progress had ceased, and despotism, tempered by assassination, crushed out all vitality. Gibbon styled the history "a tedious and uniform tale of weakness and misery." It is known now that this was unjust. The most striking fact about the Byzantine Empire is its "constant vitality and power of recuperation." It was repeatedly threatened by invaders, but it repelled them all. At times it lost some of its most fertile provinces, but at other periods it would rise triumphantly and recover lost possessions. Throughout the period between 700 and 1100, Constantinople was the bulkwark of Europe, against which the waves of invasions rolled in vain. In addition to being a bulkwark, Constantinople was, throughout the Middle Ages, the great storehouse of the Greek and Roman civilizations, where it was preserved until the European nations were sufficiently advanced to profit by it. Constantinople (q.v.) was also the most important commercial centre of the Middle Ages. The city was marvelously wealthy and excited the admiration of every traveler. Most of the Crusaders passed through Constantinople and the Greek lands on their way to Jerusalem; by them the influence of its civilization was widely spread throughout the West. See BYZANTINE EMPIRE.

Moslem Civilization.— No less important was the influence of the Mohammedans. After the death of the Prophet in 632, his followers had conquered with wonderful rapidity the greater part of the civilized world. From Persia and India they held all Asia to the Hellespont. Egypt and the whole north coast of Africa, Spain and about one-third of Gaul, were under their sway within a century. Their advance in civilization was equally rapid. The Arabs had great acquisitive ability. In each country they learned the arts and sciences known by the inhabitants, and they carried this knowledge wherever they ruled. The Greek philosophy, which they acquired from the peoples in the lands formerly under Greek sway, the mathematical knowledge of India, the irrigation practised in Egypt, are illustrations of their acquisitions, which enabled them, in the 10th and 11th centuries, to develop a civilization far in advance of any other, with the exception of the Byzantine. From Bagdad to Spain this culture was spread throughout the Mussulman world. In Syria, the Crusaders were in contact with this civilization for two centuries. By their agency and by the association of Christians and Mussulmans in Spain, Sicily and other points, much of the Moslem learning was conveyed to the Christians of western Europe.

Changes in the 12th and 13th Centuries. Enrichment of Europe.— In addition to this fructifying intercourse with other civilizations, many elements in their own contributed to cause a rapid advance in the 12th and 13th centuries. Among these may be noted the increase in population, the cultivation of waste lands, the revival of commerce, the general progress along educational lines and the rise of strong kingdoms. But as it is impossible to isolate each factor and to determine the part which it played, the results will be considered as a whole and the changes which took place in western Europe after 1100 will be described.

The hundreds of thousands of Crusaders had to procure large sums of money for their equipment and journey. Consequently the precious metals which had been hoarded came into circulation as money. Instruments of credit were devised and the money circulated rapidly. Contact with other civilizations gave birth to new tastes and these were gratified by means of a greatly increased commerce which extended to all parts of Europe and even to the extreme East. The merchants became numerous and prospered. Cities increased rapidly in population and new ones were founded. The Italian cities, because of their position, prospered the most of all. The merchants became an important class because of their wealth, and by the end of the 13th century became a political factor which was recognized by their inclusion in the new parliamentary bodies.

Intellectual Advance.— The investiture struggle had caused scholars to study history in order to find precedents in support of the imperial or of the papal claims. The contact with other peoples broadened the intellectual horizon of the Western people. The new points of view with which they became acquainted led them to question the traditions which had ruled their lives. The new books, especially the works of Aristotle (q.v.), which fell into their hands, were studied eagerly. The new wealth gave leisure. Students flocked to the centres where teachers were to be found, and gradually universities arose. Roman law was fostered by the emperors; canon law by the Church. Scientific knowledge, especially in medicine, was acquired from the Greek and the Arabic works. Gothic cathedrals of exquisite beauty were built in western Europe. The deeds of the Crusaders furnished new material to literature. The old tales were reworked and given a literary form.

Growth of Monastic Orders. Temporal Power of the Popes.— No less marked were the changes in the Church. At the close of the 11th century a great wave of asceticism spread over western Europe. The idea of sacrifice caused thousands to enter monasteries, and many new orders of monks were founded. These orders vied with one another in austerity and asceticism. Their reputation for sanctity and their services to the community brought to them great donations. Their knowledge enabled them to increase their wealth. But this wealth led many to enter the monasteries from unworthy motives, and thus caused a gradual decline in their morals. The wealth of the Church, as a whole, caused many, both monks and laymen, to attack it as having departed from its Christian ideals. Heretics became numerous and had to be repressed by persecutions and the Inquisition. In the 13th century the mendicant orders became prominent, partly as a protest against the wealth of the Church, and partly as an agency to combat heresy. The ideal of service to others for which they stood became dominant in monasticism, and later orders were founded, almost universally, for some special service. See MONACHISM; ORDERS, RELIGIOUS.

The papacy, engaged in a struggle with the monarchs, felt the need of temporal power and strove for it. Innocent III had monarchs as his vassals, and wielded a temporal authority greater than that of any previous Pope. After the popes had triumphed over the Hohenstaufens they seemed to have achieved success. Their struggle with the French king, at the beginning of the 14th century, however, led to defeat and to the "Babylonian captivity" at Avignon. Then ensued the schism and the conciliar period when many felt that the general councils and not the popes should be supreme. Finally the papacy emerged triumphant, but with a changed ideal, laying less stress upon temporal power (q.v.), and more upon control over the conscience of the individual.

Chivalry. Decadence of the Knights.— In the 12th century, the clergy and the knights formed the aristocracy. The latter, too, had their period of great splendor. The ideals of chivalry, which became prominent in the 12th century, were inculcated by the Church, and the knights were often likened to the clergy as a class specially set apart by their religious vows. These ideals were also inculcated by the new literature, which glorified not only bravery and loyalty, but also generosity and luxury. The latter led to the ruin of many of the knights. Their income, arising from feudal dues, was relatively fixed. As their tastes expanded and they expended more upon luxuries, they fell into debt. The rate of interest was ruinous and they were unable to pay. Consequently many were compelled to alienate their fiefs; the monarchs and other lords of large fiefs absorbed the lesser fiefs, and there was a tendency for the knights to become retainers of the more wealthy. Their consequence as a class declined in comparison with the growing importance of the merchants. The development of strong infantry forces finally deprived them of their pre-eminence in military matters. See CHIVALRY.

Rise of the Nations.— The contact with other peoples led to the rise of a national consciousness. In the earlier days, when each feudal castle or village was practically isolated and often at strife with its neighbors, there had been little feeling of common interests. Association with foreigners brought a sense of national feeling in opposition to the foreigners. This is very marked in the armies of the second and third crusades. This movement was coincident with, and one cause of, the growth of the strong monarchies. The merchant class was also an important element in the development of the king's powers. Commerce was heavily burdened with feudal tolls and exposed to depredations by the knights. The merchants sought privileges and protection from the kings. In return they furnished them money, which aided them in extending their power at the expense of that of their nobles. The kings came to depend largely upon the cities for support in all struggles with the nobles. By their wealth the citizens were able to rival the nobles in luxury and ostentation. The sons of the merchants frequented the universities and developed into officials of the kings. More and more the kings came to depend upon the third estate and to withdraw power from the nobles.

The French Monarchy.— The development of the monarchical power took different forms in the several countries, but took place about the same time in the leading nations. In France, the Capetian kings (see CAPET) had at first little power. They had only a small territory directly under their control, and consequently only a small income. But by fortunate marriages and by confiscations they enlarged their feudal domains. Several of the kings had long reigns and the evils of a minority or a change of dynasty were avoided. Gradually all the fiefs were brought under the control of the king, and feudal usages were made the basis for the assertion of a really monarchical power. Under Saint Louis (1226–70) and his successors France was centralized and the kings became supreme. The prosperity of France was checked for a time by the Hundred Years' War (1328–1461). This was due in part to a failure of male heirs in the direct line, which enabled the English kings to make a claim to the throne on the ground that they were the most direct heirs. But France finally emerged triumphant and England lost all her territory in France. The kings, supported by the third estate, became practically absolute.

The English Monarchy.— In England the Norman Conquest (q.v.) made William supreme lord. Following the Norman feudal usages, he insisted upon an oath from each one of his subjects, and did not allow the intervention of the feudal nobles. In spite of the civil wars of the 12th century, Henry II was able to retain the supreme control. The tyranny and incompetence of John led to a revolt on the part of the barons and the extortion from him of the Great Charter. (See GREAT BRITAIN — MEDIÆVAL ENGLAND). The efforts of the kings to evade the provisions of the charter caused the union of the nobles and the third estate, the distinctive feature of the English Constitution as contrasted with that of France or of Germany. The loss of its continental possessions really strengthened England and enabled it to develop a strong government in its own island.

The German Monarchy.— Germany was a kingdom made up of great duchies. The king was strong only when he had all these duchies under his immediate control. The imperial title which he held was usually a source of weakness, because of the necessity of maintaining his authority outside of Germany. Those kings who neglected the imperial interests in Italy and Burgundy were strongest at home. Frederick Barbarossa, Henry VI and Frederick II (qq.v.), who attempted to build up strong empires, were compelled, as the price of support from their German subjects, to make constant concessions. Thus they bartered away most of their German lands and royal rights. The towns and cities, in particular, acquired privileges and practical independence in payment for their support in men and money. On the extinction of the Hohenstaufen house, Germany was divided up into many separate entities, varying in size from a duchy to a village or to a knight's fee, all claiming independence of all control except the imperial. The weak emperors of the 14th and 15th centuries were unable to maintain any effective control or order. Each emperor was intent only upon retaining his position and securing such property for his family as he could. Consequently Germany became a prey to internal dissension and division.

The Other Monarchies.— The other countries were more backward. In Spain, the Christian kings were engaged in conquering Moslem territory or else in warring with one another. These movements were going on for several centuries, and culminated just at the close of the Middle Ages. In 1492, the Moors were conquered in Granada, their last stronghold. The two most powerful kingdoms, Castile and Leon, had already been united, and 20 years later the Spanish portion of Navarre was added. In Scandinavia powerful monarchies were growing up. In the eastern portions of Europe new Christian kingdoms had arisen, especially Russia and Hungary, which were destined to play an important rôle in the latter centuries.

The Period of the Renaissance: Discoveries.— The last period of the Middle Ages is often spoken of as the Age of the Renaissance (q.v.). The name is to a certain extent a misnomer. But it is sanctioned by general usage, and there are certain factors that may be brought together, which serve to mark the transition from the mediæval to the modern world.

The travel and commerce of the 12th and 13th centuries caused an interest in foreign lands which never abated. In particular, the taste for spices, which had become common, led to attempts to secure these more easily and more cheaply. After the loss of the Christian possessions in Syria, the importation of spices into Europe was burdened with heavy tolls by the Moslem rulers through whose territories they had to be carried. To the men of the 15th century there seemed to be two possible routes by sea to the spice islands, one by sailing around Africa, the other by sailing directly west to India. Attempting the latter led to the discovery of America; attempting the former, to the doubling of the Cape of Good Hope. The result of these discoveries was to make the nations on the ocean the leaders in commerce. The Mediterranean ceased to be the centre of the world's commerce and the Italian cities lost their pre-eminence as commercial centres.

Inventions: Compass, Printing-press, Gunpowder.— This exploration was possible only by the use of the compass (q.v.). This had been known in the West by the 12th century; in the East, centuries earlier. But it was perfected as a real aid to navigation only in the 14th century. About the middle of the 15th century came an even more important invention, that of printing (q.v.). This resulted at once in increasing enormously the number of books in existence and in cheapening their cost to one-fifth or less, so that books were readily accessible to a much larger number than before. At about the same time the manufacture of gunpowder was being perfected. Compositions similar to gunpowder (q.v.) had long been known in the East, and the knowledge of the composition of "Greek fire" had been brought to the West. But it came into general use only in the 15th century, and the guns long after that were held by many to be inferior to the cross-bow. But gunpowder, before 1500, was revolutionizing the art of war and rendering the mediæval knight obsolete.

Classical Literature and Pagan Spirit.— Contemporary with these discoveries and inventions was the awakening of an interest in classical literature. In the 12th century there had been at some centres an eager study of the Latin classics, but, in the 13th this had been superseded to a great extent by the branches considered more practical, especially law, mathematics and science. In the 14th and 15th centuries men turned again to the classics, and Greek, which had long been neglected, became a favorite study. Along with the study of the pagan authors developed a new feeling for art, which resulted in the wonderfully natural works of the Renaissance artists. Other sides of this new activity were manifested in the more scholarly spirit of criticism and in scientific study. In fact, with the period of the Renaissance modern history had dawned.

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HISTORY, Modern. General Characteristics.— When History is divided merely into Ancient and Modern, the term Modern applies to history subsequent to the 8th century A.D. The AMERICANA, however, keeps to the more usual triple division into Ancient, Mediæval and Modern; and with this classification Modern History begins about the year 1500.

At that date, as for several centuries preceding it, the scene of human progress was confined to western Europe, and the actors were the Latin and Teutonic peoples. Except for Poland with its Latin church and borrowed German culture, eastern Europe was outside the pale of civilization. The barbarous northern Slavs seemed doomed to Tartar domination, and the somewhat less barbarous southern Slavs with the neighboring Magyars were enslaved by the Turk. From the devouring victorious march of the Turk even central Europe was in imminent peril.

Even in western Europe, nations, in the proper sense, were not made; and the political map bore faint resemblance to that of to-day. There was one Latin Christendom, binding in feeble union the several geographic units. But most of the units themselves were broken into fragments under local rulers; and these fragments, sometimes of widely separated lands, were recombined, with kaleidoscopic confusion, in loose, shifting aggregates which possessed not even permanent names. Out of this feudal chaos, strong monarchies were just emerging, to organize states, in France, England, Spain, Austria and Bohemia, Sweden and Denmark. Like governments had appeared, too, in Hungary and Poland; and Switzerland and the Netherlands were loosely related to the Austrian monarchy. There was hardly a prophecy of a Germany or an Italy.

The rise of monarchic states is the change that marks the close, *politically*, of the Middle Ages. At the moment it seemed a disaster to many good men, like Dante, who clung to the old ideal of a united Christendom. But since the days of the old Roman Empire, Europe had never known a true union. "Latin Christendom," in its best period of union, had been made up of various layers of society — nobles, burgesses, artisans, priests, peasants; and the horizontal cleavages between these classes had been more fatal to unity of spirit and to progress than the new cleavage into nations was to be. One class had been more foreign to another in the same land than France to England. French noble and German noble were always ready to make common cause against French peasants or German townsfolk. The new monarchies were to change all this. The real mission of each of them, whether the monarchs saw it or not, was to weld all the classes within its land into one people. While this was being done, some old class liberties were lost. But the way was being paved for a new popular freedom, broader and safer than the world had ever known.

Until 1250, for centuries Italy and Germany had been the two centres of interest in Europe. Each had claimed universal empire; and its overreaching claim had left each broken in fragments. Not for centuries was either to attain to this new political form of a united monarchy. Leadership therefore had passed from these two lands to France, Spain and England,— the three countries in which the new movement was most advanced. Germany and Italy were to be, for long, little more than a battleground for these neighbors.

The social and economic conditions of the year 1500 made a dismal picture. Society was hopelessly aristocratic and predominantly militant, and it was crystallized in strata. The skilled industry of the towns was managed upon the guild system; and agricultural labor, except in England and some other small districts, was carried on by serfs.

But Europe had been astir with dim impulses to change for 400 years,— ever since the Crusades broke the torpor of the Dark Ages and prepared the way for the rise of towns and the Renaissance. Near the close of the 15th century the tendency to progress became more pronounced, and the lines of activity more varied. Louis XI in France, the Tudors in England, Ferdinand and Isabella in Spain, prepared the way for new consolidated political societies, and for new principles of government; the invention of printing made possible the preservation and utilization of the recently rediscovered Greek learning and the rapid dissemination of new ideas; the discoveries of Columbus and Vasco da Gama set free undreamed-of energies among the lands of the Atlantic seaboard, and summoned commercial Europe to a right-about from east to west; the adoption of gunpowder in the wars between Francis I and Charles V marked the passing of the military superiority of the knight in armor, and undermined the citadel of aristocracy in politics; the opening of the Protestant Reformation (1520) shattered the old unity of Christendom, and, together with the Catholic Counter-Reformation, called out new energies in the fields of morals and intellect. Within two generations, the one just before and the one just after the year 1500, there stood revealed not merely a new physical hemisphere and new continents in the old one, but also a new universe of thought and feeling. Europe had passed into a new age.

The four centuries of Modern History have been a period of constant, marvelous, increasingly rapid transformation,— intellectual, political, industrial. The stage itself has widened from a corner of the smallest continent into wellnigh the whole surface of the globe. The actors have multiplied, until they promise in the near future to include all branches of the human race. The drama has become infinitely complex, with the interaction of countless streams of influence. As compared with Ancient or Mediæval History, Modern History deals with a brief time, but with vast spaces, complex relations and accelerated progress. The separate movements that make up the bewildering maze are discussed severally in some detail, under appropriate headings, in the AMERICANA. This article attempts only to marshal them in such order as to bring out the essential relations between them.

It is convenient to divide the four centuries of Modern History into the *age of monarchic states* and the *age of nation-states*. The American and French Revolutions make the transition from one to the other, and the most satisfactory dividing date is 1789.

FROM THE REFORMATION TO THE FRENCH REVOLUTION.

Monarchic States.— The constant warfare of the 16th, 17th and 18th centuries is the simplest thread by which to connect the other movements of the age. Speaking broadly, the contests of the first half of the period, to 1648, are «religious wars,» Catholic against Protestant, while after 1648 the struggles grow out of dynastic and commercial rivalries.

The declaration of the war which split Christendom into opposing camps for over a century came in 1520, when Luther burned the Pope's bull. The Diet of Worms at once pronounced against the rash monk the ban of the Empire; and the decree would have been enforced, and Protestantism stifled at its birth, if the young emperor, Charles V, had had a free hand. But Charles had just become involved in strife with Francis I, over the claims of Spain and France in Italy, and he was kept busy with war against France and the Turks until 1544. For a generation, therefore, the new faith was left to spread itself unchecked over Germany and Scandinavia, while during the same period the English Church cut itself off from Rome, and Presbyterian heresy made headway in France and Switzerland. For a time, indeed, Protestantism threatened to conquer even the south of Europe; but the Catholic Counter-Reformation, with equal zeal and superior skill, finally saved the Romance lands to the old faith.

Religious Wars, 1546–1648.— Meanwhile, entangled in his strife for European sovereignty, Charles could not strike at Protestants in Germany until 1546. It was then too late. In 1555, after brief struggles, the princes of the Schmalkald League forced upon him the Peace of Augsburg; and, though troubled with incessant bickerings, Germany had no further civil war for 60 years. Just that period, however, was filled with terrible religious contests in the Netherlands and France; and then the age of religious wars closed with another civil war in Germany,— the most destructive in European history, until the World War of 1914. But the century of strife from the opening of the Schmalkald War to the close of the Thirty Years' War (1546–1648) did not materially alter religious frontiers. Catholicism, to be sure, made some conquests with the sword,— Bohemia, South Germany and the southern Netherlands,— but in most of these districts, as in the Latin countries of southern Europe, the Counter-Reformation was making rapid gains before war began.

The close of the period of religious war is marked by the decay of Spain, the continued disruption of the Holy Roman Empire and the rise of France and of the Dutch Republic. To explain these changes it is needful to dwell somewhat further upon the wars.

In 1556–57, after his failure in Germany, Charles V resigned his crowns — the Austrian possessions passing to his brother, and the Spanish to his son, Philip II. Despite the division, Philip was far the most powerful monarch in the world. Each year the gold fleet filled his coffers from the exhaustless wealth of the Americans and in 1580 Portugal with her East India empire fell into his hands. This was the power — supreme in Europe and sole mistress of the New Worlds, east and west — against which the petty, disunited Netherland provinces dared to rebel. Beginning as a political revolt in 1568, the struggle soon became a religious war; and it was waged for more than 40 years with a relentless fury which made it a byword for ferocity even in that brutal age. The 10 southern provinces were finally brought back to Spanish allegiance; but the northern provinces — Dutch in blood and Protestant in religion — fought on with desperate courage until they won independence. At the same time they preserved political and religious liberty for the world. Midway in the struggle, Elizabeth of England sent some tardy aid. Philip then turned upon England; but the destruction of his «Invincible Armada» in the splendid sea-fight in the Channel not only saved England at home but also paved the way for the English colonization of North America. The war closed in 1609. Spain had sunk into a second-rate power, never again to play an important part in European politics; but the United Provinces, through the stage of the desolating war, had grown prosperous. They drew wealth, not from wasted land, but from the sea, plundering the new possessions of Spain in the East Indies and building there a colonial empire for themselves. For most of the century, in intellectual, commercial and industrial activities, the Dutch held the first place in Europe.

In France the Edict of Nantes (1598) closed the wars of religion by guaranteeing toleration and handing over certain garrisoned towns to the Huguenots as security. During the next half century, under the wise administration of Henry IV and then of Richelieu, the industry of the people restored prosperity with marvelous rapidity. Richelieu crushed the feudal nobles and recaptured from the Huguenots their garrisoned towns. In other respects, however, he kept toward the Protestants the pledges of the Edict of Nantes; and as he warred upon the Protestants within France in order to strengthen the royal power, so he aided the Protestants of Germany in the Thirty Years' War in order to make France supreme in Europe. France had long been in real peril from the Hapsburg powers of Spain and Austria, which ringed her about in hostile embrace; but the failure of Spain against Holland and Richelieu's policy of weakening Austria in the German war removed the peril, and, as Spain declined from the first place in Europe, France stepped into it.

Meantime the Thirty Years' War (1618-48) was desolating central Europe. The princes of North Germany proved timid and incapable; and the cause of Protestantism was saved only by foreign intervention — by Denmark, by Sweden and finally by Catholic France. At the close of the struggle, the first European Congress reorganized Europe. By the Peace of Westphalia, France received most of Alsace and some other Rhine districts. The independence of Switzerland and of the United Provinces was formally recognized; and the second of these two republics ranked as one of the Great Powers. Sweden, already reaching down both west and east shores of the Baltic, secured much of the south shore also, with command of the mouths of the German Oder, Elbe and Weser. On the other hand, the empire lost more than territory. The political rearrangements within that state reduced the imperial Diet to the level of a useless debating society and put an end to whatever shadow had persisted of national unity. From this time until it vanished, a century and a half later, the Holy Roman Empire was a meaningless survival, cumbering the earth. Henceforth the Hapsburg «Emperors» derived their only real importance from their position as hereditary archdukes of Austria; and soon they turned to their proper task of defending Europe against the Turk. To most of Germany the war had brought blasting ruin. Half the population and two-thirds the movable property were swept away. Land tilled for centuries became waste, and men became savages. Not till the middle of the 19th century did large districts again contain as many homesteads and cattle as in 1618; while the low position of the German peasantry, until 1850, was due in great measure to this war.

American Colonization.— Before the religious wars closed, the continent of Europe had ceased to be the sole scene of important historical development. American colonization was well advanced and political liberty had received a remarkable development both in England and in English colonies. These topics demand attention before the student enters upon the consideration of the next period of European wars.

Spain made her first settlement upon the American continent at the Pearl Coast in 1513. Then sweeping to north and south, she took swift possession of all South America except Portugal's Brazil, all Central America and Mexico, and of the Floridas and Californias, far up both coasts of North America, while plans were afoot to plant her flag over the rest of that continent. But the ruin of the Armada, together with Spain's decay at home, came in time to leave room for other colonization. France seized upon the mouths of the Mississippi and the Saint Lawrence, the apparent gateways to the continent; and English colonies stretched themselves in patches along the fringe of the North Atlantic coast. The Dutch spent their colonizing energies mainly in the Orient; and, despite some ambitious beginnings, Sweden soon grew too weak to be a serious factor in North America. Thus that continent was left in dispute between Spain, France and England. The contest was to be interwoven with the European wars of the last half of the 17th century and of the 18th century, and the outcome was big with consequence to the world. All European countries except England governed their colonies on despotic plans. The English colonists took to the New World institutions and principles of freedom, and soon gave them a wider development there than had been possible even in the old home. Besides the rights of free speech and jury trial and habeas corpus, each English colony had from the first, or very quickly inaugurated, a representative legislature with full parliamentary privileges and with control over taxation. In several colonies, local government also was conducted on extreme democratic principles. Not until 200 years later did any of these free principles appear in the colonies of any other people — and then only because of their success in the English colonies.

England in the 17th Century.— In England itself the 17th century saw an important development in free government. Through the engaged in a critical struggle between the royal claims of «Divine Right» government and the rising spirit of popular government. Except for brief intervals the conflict was parliamentary, not military, but it was constant and stubborn. Much of the time it was confused with ecclesiastical questions, which, to the men of the time, often seemed the chief issue; and it was fortunate, indeed, that the stern heroism of Puritanism became engaged on the side of political liberty. During this century, too, England was the last remaining battle ground in Europe for free government. In the other large states,— in Spain, France, Austria, in the Scandinavian lands, even in the petty principalities of Italy and Germany,— despotism was triumphant. In England, popular principles not merely maintained themselves against the Stuart attack: they came out of the conflict with increased vitality. The great experiment of a Puritan Commonwealth failed; but after the Stuart Restoration it became apparent that the body of the monarchists themselves were now thoroughly devoted to parliamentary government, and the attempt of the later Stuarts to set up a personal absolutism called forth the «Glorious Revolution» of 1688, which established the supremacy of Parliament over the king.

Dynastic and Commercial Struggles, 1648–1783.— We now return to the general development of Europe after 1648. On the Continent the period from the Peace of Westphalia to the French Revolution (1648–1789) is marked (1) by absolutism within the several states and (2) by dynastic interests in their foreign relations, — with incessant selfish war, as the result. The famous phrase ascribed to Louis XIV of France,—«I am the State,»— might have been used appropriately by any monarch of the time outside of England. A few great rulers dominate the period. Indeed the stage is largely filled by three monarchs,— Louis XIV (1643–1715), Peter the Great (1689–1725), and Frederick the Great (1740–86). The influence of Peter was restricted for the most part to Russia, which had thrown off the Tartar yoke a century and a half before, and had been looming an indistinct menace on the East. But the other two monarchs belong to all Europe, and the period divides itself naturally into the Age of Louis XIV and the Age of Frederick II. The chief aim of statesmen was to prevent any one country from becoming too strong for the safety of its neighbors. The Peace of Westphalia had transferred political predominance from the Hapsburgs to the Bourbons. Thus, during the first half of the period France threatened the «balance of power,» and league after league of other powers was organized against her. International morality, however, was low; and commonly rulers were willing to let a strong power rob a weaker one if they could find «compensation» by robbing some other state themselves. In the last wars of Louis XIV, just before and after 1700 (known in American history as King William's War and Queen Anne's War), the dynastic interests of European ruling families became merged in a titanic, century-long struggle between France and England for world dominion,— though neither country was yet fully conscious of the import of the strife.

In Europe, France was no longer in peril, as she had been in the period preceding Richelieu; and Louis the Fourteenth's half-century of war was merely a struggle to enlarge his dominions. For a generation the victories of Turenne dazzled Europe; and France annexed some important strips of territory on the east, at the expense of Spain and of the decaying empire. But in the closing period, when the Allies also had found great generals, in the English Marlborough and the Austrian Prince Eugene, even success in the field deserted Louis; and to a comprehensive view his failure was profound. Exhausted France was crushed by taxation to pay the interest of the war debt; while, in attacks upon petty provinces in Europe, she had wasted energies and opportunities that might have made her supreme in Asia and America. Within, the economic reforms of the great Colbert were abandoned; and the revocation of the Edict of Nantes (1685) drove into exile more than 200,000 of the best citizens of France. The effect corresponded in a measure to the effect upon Spain of the expulsion of the Moriscoes somewhat earlier. The Huguenots had comprised the skilled artisans and the enterprising merchant classes; and their flight added to the terrible economic demoralization and deprived France of all chance at industrial leadership.

To men of the time, however, the failure was partially disguised by the glamor that surrounded the court of the *Grand Monarque.* French literature, brilliant and sparkling, was in its first splendid period; and French intellectual leadership survived for more than a century. Until after 1800, the court of Louis XIV remained the model for every court in Europe; and French thought, French fashions and the French language were the common property of all polite society.

The Treaty of Utrecht (1713), while it left France still one of the three greatest powers, marks her recession from predominance. Spain resigned her territories and claims in Italy and on the Rhine, and, except for her decaying colonies, withdrew finally within her own peninsula. England gained Newfoundland and Nova Scotia from France, and in Europe she secured command of the Mediterranean by the conquest of Gibraltar and Minorca. By the same treaty and by the rearrangements that immediately followed, the old Spanish Netherlands, the duchy of Milan, and the kingdom of Naples and Sicily fell to Austria. The Duke of Savoy (one of the faithful allies against France) acquired Sardinia, with the title of a kingdom for his enlarged state. A little before, in 1701, the Elector of Brandenburg had secured the title of king of Prussia. Thus, out of the wars of Louis, at the beginning of the 18th century, arose the two kingdoms, Prussia and Sardinia, which in the latter part of the 19th century were to make modern Germany and modern Italy against the will of modern France.

About 1700, other important changes took place in the map of Europe. For three centuries, Austria had been one of the chief bulwarks of Christendom against Mohammedanism. In 1683 Vienna had been besieged by the Turks and had been saved only by the arrival of the gallant Sobieski with his Polish chivalry. But thereafter Austria took the offensive. She won back Hungary, and then, step by step, extended her domains down the Danube valley and the Illyrian coast. In the latter part of the reign of Louis XIV, the Austrian Hapsburgs, turning away from the Rhine, definitely adopted a Danubian policy and sought to aggrandize themselves by seizing Slav territory from Turkey.

This new policy of Austria gave Louis XIV a freer hand on the Rhine than he otherwise would have had, and so helped on the decline of Holland. In 1640 Dutch vessels carried the commerce of the world,— even the greater part of that between England and her colonies. Soon after that date, however, England attacked the Dutch commercial supremacy by navigation laws, and at last by war. Fearful of French conquest, and deserted or timidly defended by Austria, Holland had no choice but to ally herself to her commercial rival. After 1689 in particular (when William of Orange became king of England), Holland followed the lead of England in politics, while that country drew to herself the Dutch carrying trade.

In the north of Europe the former great powers, Sweden and Poland, were declining before the rise of Russia and Prussia. Peter the Great (1689–1725) consolidated the government in Russia, introduced a veneer of Western civilization and started his country on its deliberate march toward distant seas, west, south and east. Peter himself secured the western «window» by seizing from Sweden the southeastern Baltic provinces. In the middle of the century, the Empress Elizabeth (1741–62) robbed Sweden of the rest of the Baltic coast up through southern Finland. The northern half of Finland remained Sweden's until Alexander I seized it in the Napoleonic wars; but toward the close of the 18th century, under Catherine II, Russia began her advance along the Black Sea at the expense of Turkey. Under the same ruler occurred the Russian gains in the partitions of Poland,— a story which can be understood only in connection with the rise of Prussia.

For three centuries the Hohenzollern Margraves of Brandenburg had been patiently adding scrap by scrap to their realms. Soon after 1600 these dominions lay mainly in three widely separated groups,— Cleves on the Rhine, Brandenburg on the Elbe and East Prussia beyond the Vistula. The object of Hohenzollern politics was to consolidate these provinces by acquiring intermediate territory. Toward the close of the Thirty Years' War, Frederick William, the Great Elector, made important headway in this respect and accomplished still more for his country after the close of that struggle by persistently maintaining peace and fostering industry. It was his son who in 1701 secured the title of king. The second king of Prussia built up a magnificent army and reared a son who was to use it magnificently — and treacherously. Frederick II ascended the throne in 1740 and began his long reign of an unjust but profitable war. The Hapsburg realms had just fallen to a woman, and, disregarding solemn treaties in truly Hohenzollern fashion, Frederick took unscrupulous advantage of the supposed weakness of the Archduchess, Maria Theresa, to seize from Austria the rich province of Silesia by surprise, without even the warning of a declaration of war. The heterogeneous Hapsburg realms seemed about to fall to pieces; and Spain, France, Savoy and Bavaria hurried to join Prussia in dismembering the carcass. But England and Holland threw themselves into the stuggle on the Austrian side, and the Treaty of Aix-la-Chapelle (1748) closed the War of the Austrian Succession without further territorial changes. Frederick kept Silesia, reaching far down into the heart of Germany, and Prussia stood forth as one of the great powers.

The significance of the contest, however, lay in its wide extension into India and America. Indeed, colonial war between England and Spain had already begun before Frederick appeared on the stage, and France must soon have joined Spain in any event. In the New Worlds, too, the peace restored the former boundaries; but the war marks a clear consciousness in England and France that the two were rivals for vast realms outside Europe. The family interests of monarchs as a cause for war were giving place to the commercial interests of English and Dutch merchants as opposed to those of French and Spanish merchants, while back of these selfish motives lay the mighty question, big with consequence to the world, whether French or English political ideas should hold the New World.

In 1756, Austria fortified herself by alliance with Russia, Sweden and even her old enemy France, and prepared to destroy Prussia. Frederick's supreme military genius saved his country for the moment, and the next year England came to his aid. During the brief interval between the European wars, England and France had practically remained at war in America; and now that France had joined Austria, England was constrained to support Prussia. In all the period from 1689 to 1815, no matter what the origin of the wars, England and France soon became the chief factors; and though they were at one time or another on every side of every question, they were never on the same side at the same time.

This Seven Years' War (1756–63), or Great French War, as it is commonly known in America, was literally a world-wide struggle. Red men fought by the Great Lakes of North America, and black men fought in Senegal, while Englishmen and Frenchmen grappled in India as well as in Germany, and their fleets engaged on every sea. The showy battles took place in Germany, and on the whole the European conflict determined the wider results. Pitt, with vision fixed upon a coming British empire, declared that in Germany he would conquer America from France. This he did. England furnished the funds, and her navy swept the seas. Frederick, supported by British subsidies, furnished the generalship and most of the troops for the German battlefields. The striking figures in the struggle are (1) Pitt, the English imperialist and the directing genius of the war; (2) Frederick, the military genius, who won Pitt's victories in Europe; (3) Wolfe, who won French America from the great Montcalm, and (4) Clive, the East India Company's clerk, who laid the basis for England's supremacy in India.

Changes in the World-Map; the American Revolution.— The Treaty of Paris (1763) left Europe without change; but in India France lost all except a few unfortified trading posts, while in America, England received Florida from Spain, and Canada and the eastern half of the Mississippi Valley from France. France ceded to Spain the western half of the Mississippi Valley, in compensation for the losses Spain had incurred as her ally; and, except for her West India Islands, she ceased to be an American power. Spain still held South America and half of North America; but her huge bulk was decaying day by day. Holland, too, with widespread empire, was plainly in decline. England, having dispossessed France in both Asia and America, stood forth as the leading world-power.

The American Revolution, a few years later, did not lessen this pre-eminence; but it had other results of supreme significance. The war came because the American colonies had really become a nation, and because the English government unwisely insisted upon managing American affairs after the Americans were quite able to take care of themselves. English interference in economic matters had long been irksome, and the danger of interference in ecclesiastical matters was feared. England had just relieved the colonies from fear of French conquest. External bonds were gone, and internal ties were dissolving. Then George III and his ministers supplied the necessary jar to effect separation by trying to raise revenue in America by Acts of Parliament. Astute patriots rallied the majority of the Americans by an old English shibboleth; and after a bitter eight-years' conflict (1775–83), the 13 English colonies became the first free American nation.

The Revolution «split the English race and doubled its influence.» It paved the way for a more enlightened economic science, since, contrary to all expectations, the trade of free America from the first proved more valuable to England than that of colonial America had been. It reacted upon England, so that, when the great wars were over, both that country and its remaining colonies made new advances in political liberty. It set up the standard of independence for the states of Spanish America in both continents. But its supreme importance lay in the birth into the family of nations of the United States itself, though the full significance of the new nation hardly began to impress Europe for more than two generations.

England's European enemies had seized the opportunity to attack her in a war of revenge. England came out of the contest with glory little tarnished. She had been fighting, not America alone, but France, Spain and Holland, as well; and though she had lost the best part of her old American empire she was not without compensating gains. She seized Dutch colonies at will; she strengthened her grasp upon India; she won back the undisputed sovereignty of the ocean by shattering the navy of France; she rebuffed all assailants from the rock of Gibraltar, the key to the Mediterranean; and in some measure she made good even her American loss by the acquisition of Australia just afterward.

The Partitions of Poland.— To return to continental Europe in the closing half of the Age of Frederick the Great:— one more territorial change calls for attention. Poland had fallen into anarchy under its elective, figurehead king and its oligarchic nobles. This anarchy gave the neighboring powers excuse for plunder. Catherine II determined to seize a large part of the country. Frederick II persuaded his old enemy, Austria, to join him in compelling Russia to share her booty. The First Partition of Poland (1772) pared off a deep rind. The Second and Third Partitions, which «assassinated the kingdom,» had not even the pretext of misgovernment in Poland, for the Poles had earnestly taken up the work of reform. These final divisions took place in 1793 and 1795, after the death of Frederick, amid the wars of the French Revolution. Prussia gained large extent of territory, with valuable sea coast; and most important of all, the additions brought the principal Prussian provinces,— formerly scattered,— into a compact body. But Russia gained far the greatest part of the territory, and she now bordered Germany on the east, as France had come to do earlier on the west, after the destruction of the Burgundy of Charles the Bold. The wise policy of the Germans, early and late, would have been to support the buffer states against the greed of Russia and France. Failure to do so has left Germany exposed ever since to direct attack by powerful enemies, and has compelled her to build up artificial frontiers of fortresses and bayonets, and to accept an undue militant character for all her civilization.

The Beneficent Despots of the 18th Century.— In foreign relations, the Age of Frederick the Great saw little improvement over that of Louis. In the government within the several states, however, there was a beneficent and significant change. Frederick of Prussia, Catherine of Russia, Charles III of Spain, Leopold of Tuscany, Ferdinand of Naples, Joseph II of Austria, all belonged to a new class of «crowned philosophers» and «benevolent despots» who sat upon the thrones of Europe in the latter half of the 18th century. In Sweden and Portugal, also, great ministers sought to impose a liberal policy upon the monarchs, as Turgot succeeded in doing for a while, even in France. A remarkable school of French writers,— Diderot, Voltaire, Rousseau,— had created a new, enlightened sentiment in the ruling classes, and a new sense of responsibility. Government was no more *by* the people than before, but despots did try to govern *for* the people, not for themselves. Sovereigns spoke of themselves no longer as privileged proprietors, but, in Frederick's phrase, as «the first servants of their states.» All these rulers planned far-reaching reforms,— the amelioration or abolition of serfdom, the correction of abuses in the Church, the building up of popular education. In Prussia, for a time, much was accomplished. The condition of the peasantry was improved; the administration was rendered economical and efficient; and wealth and comfort began to increase by bounds. But these happy results were secured only by the tireless energy of one of the world's greatest geniuses. On the whole the liberal monarchs made lamentable failures. One man could not lift the weight of a nation. It remained to see what the people could do for themselves. The age of enlightened despots was the prelude to the French Revolution.

THE AGE OF NATION STATES.

The French Revolution, 1789–99.— In the latter part of the Middle Ages Italy had given the world an intellectual revolution; Germany began Modern History with a religious revolution; and France now introduced the last great division of the Modern period by a political and social revolution. Pre-eminently among political revolutions, the French Revolution deserves the name. The English Revolution of 1688 swept away temporary interference with ancient principles of English politics. The American Revolution made the Americans politically independent: so far as it brought any social change, it merely hastened slightly a movement, long under way, toward democracy. The French Revolution overturned a society that had been growing up for centuries. cut loose from the past, and started France, with all the world, upon new lines of growth.

But if it destroyed the old, it also built the new. The work of destruction was needlessly horrible and bloody; but as a whole the Revolution was a vast and fruitful reform. The really significant thing is not the temporary mob-rule and bloodshed; the significant thing is the great national awakening which swept away an absurd society, founded on ancient violence and warped by time, to replace it with a simpler social system, based more nearly on equal rights.

The chief institutions of France were: (1) a monarchy, centralized, despotic and irresponsible; but in weak hands, incumbered by complex survivals of ancient local institutions, and hampered by its respect for the good opinion of the privileged classes; (2) an aristocracy, wealthy, privileged, corrupt, skeptical; and (3) an established church, wealthy and often corrupt. Below these spread the masses, a necessary but ugly substructure. Over the Continent, similar conditions held sway. In France the nobles had fewer duties, the peasantry had more completely risen out of serfdom, and more of a middle class had grown up, than in the other large countries of the Continent. Feudal society was more decayed, and industrial society was more advanced. The great European revolution broke through at the weakest spot.

The fundamental cause of the Revolution was the unjust privileges of the favored classes and the crushing burdens of the masses. The evil was no greater than for centuries, but the consciousness of it was greater. The masses had begun to demand reform; and the classes had begun to question the righteousness of their privileges. A revolution «requires not only abuses but also ideas.» The combustibles were ready, and so was the match.

Science had upset all old ideas about the world outside man. The telescope had proved that other planets like our earth revolved about the sun, and that myriads of other suns whirled through limitless space; and Newton had shown how this vast universe is bound together by the unvarying «law» of unseen gravitation. The microscope had revealed an undreamed-of world of minute life in air and earth and water; and earth, air, water (and fire) themselves had become new,— since Lavoisier had just resolved them into components and proved that they were not the «elements» the ancients had held them. Such a revolution in the way of looking at the material world prepared men to ask questions about the world of man and society. Tradition and authority had been proved silly in the one field: perhaps they might be wrong in the other. And so the Revolution was really begun by the revolt against the authority of the past among the dazzling galaxy of French literati led by Voltaire, Montesquieu, Diderot and Rousseau.

The Revolution, however, is conveniently dated from the meeting of the States-General in 1789. The king had summoned that body, hoping to induce the privileged orders to give up their exemptions from taxation, and so relieve the bankrupt treasury. The Third Estate, representing the middle class, and the liberal nobles and clergy had assembled with the determination to secure far-reaching reforms and to establish a «constitution.» A sharp contest, with a brief period of anarchy, left power in the hands of these liberal elements, where, despite some attempts at counter-revolution and some danger of mob predominance, it remained for two years. The Constitution fashioned during this period provided for a weak kingship and abolished nobility and all special privileges before the law; but it carefully entrenched middle-class supremacy against democracy by graded property qualifications and a complex system of indirect elections.

Further changes were inevitable; but, if France had been left to herself, they might have come about as quietly as these first ones. Instead, foreign war gave the movement a new character. War was inevitable. Emigrant nobles gathered their forces on the Rhine under the protection of German princes. The emperor, Leopold, brother-in-law of Louis of France, called upon the sovereigns of Europe to recognize the cause of Louis as «the cause of kings,» and demanded from France such changes in her government as should protect Europe against the spread of revolution. This presumptuous dictation in their internal affairs roused a tempest of righteous wrath in the French nation; and in 1792 war began between «the cause of kings» and «the cause of peoples.» For 23 years Europe was engaged in strife, upon a greater scale than ever before in history.

France was girdled with foes. The empire, Prussia and Sardinia, were at once in arms, Naples and Spain joined the coalition. Sweden and Russia both offered to do so, if needed. Ere long England and Holland were added to the enemies who expected to partition France. Vast armies invaded France; and the French forces were demoralized by treachery of officers and by fear of Royalist plots. If France was to be saved, it could not be done by half-measures, nor with a king in secret alliance with the enemy. Control fell to extremists; and, while the mighty Danton roused and organized the national energies, the frenzied mob, unhindered, answered the victories and boastings of the invaders by the attack on the Tuileries and the Massacres. In September, the Convention established the French Republic with extreme democratic features and with manhood suffrage. Then revolution within revolution transferred power to more and more radical factions. The defeated Girondists raised the provinces against the capital; and for a time Paris and a score of central departments faced the remaining three-fourths of France and united Europe. Out of this crisis, in 1793, grew the great Committee of Public Safety, which ruled France for a year with despotic power. The Revolution now became constructive, and never has the French genius for organization shown itself more triumphantly. The Committee deliberately adopted a policy of «Terror» to crush plots and dissension and to secure united action. Revolt was stamped out. A million soldiers were sent to the front. The invaders were rolling back in rout, and the ragged but devoted French armies swarmed victoriously across all the frontiers, to sow civil liberty over Europe with fire and sword. France was not again in serious danger from foreign foes until the fall of Napoleon, 20 years later.

Meantime, while the grim, crime-stained men of the Committee in war and tumult were organizing order within and victory abroad, the Convention was laying anew the foundations of French society and advancing the progress of the human race. It adopted the projects of Cambarcérès for the codification of French law, and the plans of Condorcet for a system of national education; it accepted Argobast's metric system of weights and measures; it abolished slavery in the French colonies, created provision for the public debt, instituted the first Normal School, the Polytechnic School, the Conservatory, the Institute of France, the National Library and began the improvement of prisons and hospitals, and the reform of youthful criminals. Meantime the peasants had become free landholders, and the whole laboring class was rising rapidly in standard of living.

In 1794 the Jacobins split into factions, and these turned the «Terror» upon one another. The following year a conservative reaction gave the Republic a new constitution, which restored property qualifications and indirect voting. But the new plural executive (the Directory) proved incompetent and corrupt, and kept itself in power only by a series of *coups d'état*. It was assailed by conspiracy, radical and royalist; and France breathed more easily when, in 1799, Bonaparte overthrew it with his troops and set up a firm military despotism, veiled by plebiscites.

Napoleonic Period, 1800–15.— For 15 years, as First Consul (1800), Consul for Life (1802) and Emperor of the French (1804–14), Napoleon was sole master of France. He preserved the principle of civil equality and all the economic gains of the Revolution, but political liberty for a time was lost. True, his rule was a denial of the old doctrine of Divine Right: each new usurpation received the sanction of a popular vote, and he boasted that he was chief by will of the people. But every form of constitutional opposition was crushed or muzzled. The legislative chambers existed only to speak when and as he chose; free speech, free press and all security for personal liberty were suppressed by a system of spies and secret police and by arbitrary imprisonment of suspects; local administration was centralized more highly than ever under the old monarchy, «nor did there exist anywhere independent of him authority to light or repair the streets of the meanest village in France.»

This all-pervading absolutism was directed by the penetrating intelligence and indomitable energy of the world's most «terrible worker»; and it conferred upon France great and rapid benefits. Order, precision, symmetry were introduced into every branch of the administration. The interrupted work of the Convention was resumed. Education was organized; law was simplified and codified; the Church was again brought into alliance with the state; industry was fostered, and magnificent public works were carried out. But in all this, Napoleon was merely the last and greatest of the beneficent despots. And in the outcome, his rule fixed more firmly than before in the mind of the nation the dangerous willingness to depend upon an all-directing central power; so that in our own day, after many revolutions, the supremely difficult task of the Third Republic has been to create the spirit of local self-government.

No doubt, in 1800, when Napoleon came into power he sincerely desired peace, in order to reconstruct France. By the brilliant victories of Marengo and Hohenlinden he dissolved the hostile coalition, and a series of treaties, closing with the Treaty of Amiens (1802), gave Europe a breathing spell. But soon Napoleon again desired war. His victories in Italy, as a general of the Directory, had first brought him to the world's notice, and only military glory could keep France from murmuring at his rule. Moreover, he aspired frankly to European empire. On the other hand, the nations felt that there could be no lasting peace with him except by complete submission to his will. In 1803, England and France renewed their strife, and between these powers there was to be no more truce until Napoleon's fall 11 years later. In that time Napoleon fought also three wars with Austria, two with Prussia, two with Russia, a long war with Spain and various minor conflicts. From 1792 to 1802, the unceasing European wars belong to the Revolutionary movement. From 1803 to 1815, they are properly Napoleonic wars, due primarily to the ambition of a great military genius. In the first series, Austria was the chief opponent of the Revolution; in the second series, England was the relentless foe of Napoleon.

Napoleon's insight readily divined his true enemy; but Nelson's great sea fight put an end to all possibility of directly invading England. On the Continent, however, victory followed victory. After Austerlitz (1805), Austria gave up her remaining Italian and Illyrian territory and many of her possessions in Germany. After Jena (1807), humiliated Prussia was reduced half in size, thrust beyond the Elbe and bound to France by a shameful treaty. Less decisive conflict with Russia was followed by the diplomatic victory of Tilsit (1807). Emperor and Tsar entered into friendly alliance. France was to have a free hand in western Europe; Russia was to be permitted to aggrandize herself at the expense of Sweden, Turkey and Asia; and the two were to join in ruining England by enforcing Napoleon's «continental system.»

The refusal of Portugal to obey Napoleon's command for the confiscation of English commerce led to the seizure of that state. Then followed a like seizure of Spain, out of which grew the long Peninsular War, which, as Napoleon confessed afterward at Saint Helena, was really the canker that destroyed him. At the time, however, it seemed trivial, and for five years after Tilsit Napoleon was master of the Continent. At its greatest extent the huge bulk of France filled the space from the ocean to the Rhine, including not only France as we know it, but also Belgium, half of Switzerland and large strips of Germany, while from this central body two outward-curving arms reached toward the east, one along the North Sea to the Danish Peninsula, and the other down the coast of Italy past Rome. The rest of Italy and half the rest of Germany were under Napoleon's protection, ruled as a vassal states by his brothers and generals. Denmark and Switzerland were his willing allies and Prussia and Austria were unwilling ones. Sweden and Russia, though nominally his equals, were allowed that dignity only because they upheld his policy. Only the extremities of the Continent — the islands of Sicily, Sardinia and England, and the mountainous Spanish Peninsula — kept their independence, at the cost of wasting war.

The period was filled with important rearrangements for Europe, territorial, political and social. Many of these were designed in selfishness; but nearly all were to bear good fruit.

In Germany, even the territorial rearrangements paved the way for later national unity. Not only the 1,500 anarchic territories of the "knights," but also the 300 petty, scattered, despotic principalities, ecclesiastical states and oligarchic city-republics (with a few exceptions) were absorbed in larger neighbors; so that the multitudinous, ill-governed states of the vanished "Empire" were consolidated into less than 40. Most of these reorganized states, outside Austria and Prussia, were further combined in the Confederation of the Rhine; and in this Confederation as well as in the German and Italian territory annexed to France, and in the various vassal states over Europe, serfdom and feudalism were abolished and civil equality and the Code Napoleon were introduced. The administration of justice was made cheap and simple, and the old clumsy and corrupt methods of government gave way to order and efficiency.

Most important of all, similar reforms were adopted in Prussia, not from French pressure, but by the influence of the Prussian Minister, Stein, who sought to make his country strong enough to throw off the French yoke and to regenerate Germany. Napoleon's insolence had at last forced part of Germany into a new national patriotism; and that patriotism began to arm itself by borrowing weapons from the arsenal of the Revolution.

Napoleon's "continental system," if embarrassing to England, was ruinous to Europe. Moreover, Tsar Alexander began to suspect Napoleon of intriguing against him in Finland and Turkey; and in 1811 he refused longer to follow Napoleon's commercial policy. Napoleon declared war. The destruction of his Grand Army amid Russian snows was the signal for the rising of the peoples of central Europe in the Wars of Liberation. Napoleon, like a desperate gamester, refused all terms, and finally was crushed and deposed. The Bourbon dynasty was restored to the throne of France, and the powers met in the Congress of Vienna (1814–15) to reconstruct the map of Europe.

The Congress of Vienna.— In its desires, that Congress stood for reaction. Says Fyffe, "It complacently set to work to turn back the hands of time to the historic hour at which they stood when the Bastille fell." It ignored peoples, and considered only princes. Its work, therefore, had to be slowly undone through the next half-century.

Still, its power for restoration was less than its wish; and even its most selfish work contained seeds of progress. Nobody thought of restoring the old ecclesiastical princes, nor of undoing the consolidation of Germany. That country was left in 38 states, and Italy in 12. Austria, which had lost territory in central Europe, received its compensation in Italy, so that its despotic energies were more than ever drawn away into Italian and Danubian questions. Renovated Prussia, in return for Slav lands, which it ceded for the tsar's new kingdom of Poland, received German territory — half of Saxony, the Pomeranian sea coast and German provinces on the Rhine taken from France. Thus, reaching down into the heart of Germany, and with distant isolated districts to defend on the Rhine and on the Niemen, Prussia stood forth the natural champion of Germany against Slav and Gaul. In like manner, Sardinia's gain of Genoa was one more step in the consolidation of Italy. In return for the vast national debt incurred in supporting coalitions against Napoleon, England added still further to her colonial supremacy by holding South Africa, Cyprus, Malta and other important stations. Despite its brief welcome to Napoleon at his return from Elba, France was wisely left with the boundaries she had when the Revolutionary wars began. The most serious disappointment to the liberals was the failure to secure a national union in Germany. Reactionary Austria secured instead the Germanic Confederacy — a loose league under Austrian presidency, with a Diet which was merely a meeting of ambassadors — "a polite and ceremonious means of doing nothing."

It was worth much to Europe merely to recognize that it had common interests which could be arranged by a peaceful congress. Even this gathering of despots was an advance from 18th century politics toward a better international organization. Some of its work, moreover, was distinctly progressive, such as the declaration (secured by England) against the African slave trade, the opening to commerce of the rivers flowing between or through different countries, and especially the neutralization of Switzerland under the protection of the powers.

The Industrial Revolution.— Here it is needful to interrupt the political survey to trace a vast economic movement. While France had been giving the world her great social and political revolution with noise and blood, in England an even greater "industrial revolution" had been brought by humble workers busied in homely toil, puzzling day after day over wheels and belts and levers, seeking some way to save time. In the days of Voltaire and George Washington men raised grain and wove cloth and carried spare products to market in the same way in which these things had been done for 4,000 years. The farmer with strenuous toil scratched the soil with a clumsy wooden plow, not unlike those pictured on Egyptian monuments 6,000 years ago. He had no other machine for horses to draw except a rude barrow and a cart. He sowed his grain by hand, cut it with the sickle of Tubal Cain and threshed it with the prehistoric flail. Carpenter's tools differed little in number or style from a set, 4,000 years old, recently found in Crete. The 17th century had seen the invention of sawmills driven by water (like the still earlier grist mills); but these only cut logs into rough boards; all planing and dressing of lumber was still hand work. Merchandise was still carried on pack horses or mules; and travel was mainly on horseback, though slow six-horse coaches toiled along on a few main roads, at perhaps four miles an hour. No woman had ever cooked by a stove. Household lights were dim, ill-smelling candles or smoky and flaring torches. If a householder carelessly let his hearth fire go out, he borrowed live coals from a neighbor or struck sparks into tinder with flint and steel. If a leg was to be amputated, the agony had to be borne without the merciful aid of anæsthetics. The few cities were still small and mediæval, without water supply, sewerage disposal or regular police protection. London was the only town in Europe that boasted lamp posts.

The first improvements came in agriculture. By the middle of the 18th century English landlords were introducing a scientific crop rotation — which then brought with it a helpful circle of gains — larger crops, more stock, richer soil. The increase in farm products, together with the new interest in agriculture, led, about the beginning of the next century, to the invention of the cast-iron plow, the cradle-scythe and the threshing machine. Even sooner it led to better facilities for transportation,— turnpikes, macadamized roads and lock-canals.

The main change that was to revolutionize working society, however, came not in farming but in cloth manufactures. In the 17th century the primitive distaff for drawing the fibre of flax or wool into thread had been replaced by the wheel, run first by hand, but afterward by the foot of the spinner. But the spinning wheel spun only one thread at a time, and one weaver with his clumsy hand-loom could weave into cloth all the thread eight spinners could supply. In 1761 the English Royal Society for the Encouragement of Manufactures offered a prize for an invention for swifter spinning. Then in swift succession, Hargreaves' «Jenny» (1764), Arkwright's «Water Frame» (1771) and Crompton's «Mule» (1779) enabled one spinner to spin 200 threads at a time. The weavers still using the hand loom older than any records of history could not keep up with this until (1784) Cartwright invented a power loom whose shuttle automatically threw the wool back and forth through the warp. After that, both spinners and weavers needed more raw material. This need was met in America after Whitney's Cotton Gin (1793) made it possible for one slave to clean as much cotton fibre from seed as 300 slaves could clean before. To use the vastly increased supply of cotton there was needed a better motive power for manufacturing machinery, and by 1785 Watt's improvements on the pumping steam-engine had produced an engine that worked swiftly and economically, and which could transmit its power to wheels by an arrangement of shafts and cranks. By 1800 there were more steam-engines in England than water wheels, and the age of steam and iron had begun for that country. Since prehistoric man found ways to make fire and bake pots, and make spindles, and extract iron from the ore, there had been no change in man's work and life comparable to this tremendous change in the last quarter of the 18th century.

The English inventions were soon known in America, but they came into common use there only when the War of 1812 forced Americans for a time to manufacture all their cloth. In 1800 that country had only four steam-engines, and its four small cotton mills were run by water wheels. From the continent of Europe, too, the new age was shut out for some years by Napoleon's «continental system»; and it did not really establish itself there, even in industrial and progressive France, until about 1830. The problems of the new system had to be met first in England.

With machinery and steam, one worker was soon producing more wealth than hundreds had produced by the old hand processes. Part of the marvelous increase went to the common gain, in lower prices, but to multitudes of the workers the industrial revolution meant not higher life but lower life. This was not the fault of Hargreaves and Watt; the fault lay in the imperfect organization of society. The inventors had swept away the cumbrous and outgrown «Domestic» system of manufactures for an efficient and economical «Factory» system. But the new machinery was costly. Workmen could not own it as they had owned their spinning wheels and looms; nor did they know how to combine so as to own it in groups. And so far-sighted individuals of wealth built huge factories, story on story, filled them with the new machinery, furnished the raw material, paid wages to hired «hands» and took to themselves the bulk of the new wealth. The new factory system became also a capitalist system and a wage system.

At a touch, the factory system had changed magically the face of England — as soon it was to change the face of the civilized world. In 1750 England was still rural, with only five towns of more than 6,000 people; in 1800, it had 100 such towns, and its total population had already nearly doubled. In the next 50 years, it doubled again, and the towns much more than doubled in size and number. And this growth of towns — long without water supply or garbage collection — brought new problems which at first no one saw clearly and with which neither science nor law was then fit to grapple.

And in the new cities appeared two new elements in human society: the capitalist manufacturer, dwelling in his pompous mansion and soon dominating middle-class society; and the capitalless and landless proletariat of pallid factory workers, with nothing to sell but their hands. This new class was at first made up of old workers drawn away from their rural homes,— with garden spots, fresh air and varied industry,— to herd in squalid, indecently crowded tenements, bordering on pestilential alleys, amid destitution, disease, filth and vice. In 1837, one-tenth the people of the great city of Manchester «lived» in cellars.

These destructive tenement conditions were due to general ignorance, to the poverty of the workers and to the careless greed of the employers. Even more disastrous conditions within the factory itself were due directly to capitalistic selfishness. Multitudes of men were clamoring for work, and much factory work could be done by women and young children. The operatives had not begun to bargain collectively; and the employer fixed wages and hours at will. Accordingly, the "dawn-to-dark" working day was brought from out of doors — where it was endurable because spent in fresh air and in varied activity — into the factory, where it was unendurable because of foul air, poor light, incessant nerve-racking noise of machinery, and because there it crushed women and young children so as to become a menace to the national life. These conditions in England, from 1800 to 1834, are too notorious to need amplification. Even in America as late as 1832 a committee reported that two-fifths of all factory workers were children whose day of toil averaged 14 hours — every day of the year except Sundays and the few holidays — and who had no chance whatever for schooling.

The new society soon begot new social philosophies. The prosperous capitalist class resented all thought of interference in their business by government. Such meddling by the paternalistic governments of the past, they easily proved, had been harmful, even when best intended; and the new science of political economy, founded by Adam Smith, taught remorselessly that the "greatest good of the greatest number" could be secured only by non-interference with the "natural laws" of supply and demand. This *Laissez faire*, or Manchester, doctrine soon became the religion of the town middle-class; but from the first there were raised voices to protest that it united the strong but was merciless and unchristian to the weak. Against the teachings of that "dismal science," such thinkers at once set up an opposing set of doctrines; and before 1850 the utopian socialistic dreams of Owen, Fourier and Saint Simon had grown into the scientific socialism of Karl Marx.

Now we may turn back to the course of political history.

From 1815 to the Revolutions of 1820.— For more than 30 years after the Congress of Vienna reaction held sway in Europe. The restored princes, who "had learned nothing and forgotten nothing," strove to ignore the progress from 1789 to 1815. In Sardinia, serfdom was restored; in Spain and the Papal States, the Inquisition and other mediæval institutions; in some places, even street lamps were abolished along with other hateful French reforms. Five states,— Russia, Austria, Prussia, England and France,— determined the policy of Europe. The first three were divine-right despotisms; and though the tsar and the king of Prussia played for a time at liberalism, the first disorders enabled Austria to draw them over to her own frankly reactionary program. At first, France and England were not much better than these Eastern powers. Louis XVIII had found it necessary to give France a charter; but in that document itself the theory of divine right was preserved, until the revolutionary changes of 1830. That theory could have no place in England; but even there the government was for many years in the hands of an extreme Tory party. The evil genius of the whole period was the subtle Austrian statesman, Metternich, with his motto, "Government is no more a matter for debate than religion is." The one good thing to be said for Metternich's long supremacy is that he permitted no great war; and this was because he felt it necessary to hold the powers in friendly alliance, so as better to arrest progress within the lines drawn at the Congress of Vienna.

However, beneath the tide of reaction, the principles of the Revolution survived. The two positive forces in politics for the 19th century were to be democracy and nationality. The league of princes compelled them to work underground; but before the middle of the century they emerged in three series of revolutions — in 1820, 1830 and 1848.

The revolutions of 1820 started in Spain, to re-establish the Constitution of 1812, which had been adopted first during the war for Independence. Completely successful there for the time, the movement spread swiftly over the southern peninsulas — to Portugal and to the states of North and South Italy, while it stimulated the Greeks rising against the Turks. Metternich found a weapon of repression ready. After Waterloo the four great allies, Russia, Prussia, Austria and England, had agreed to preserve their union against revolutionary France by holding occasional congresses. Metternich now summoned these powers to the Congress of Troppau. Here the despotic masters of Russia, Austria and Prussia signed an agreement to unite in putting down revolution against any established government. England protested and withdrew from the alliance; but her place was taken by France, and the united despots, popularly known as the "Holy Alliance," proceeded to carry out the Troppau program. With overwhelming armies they crushed constitutionalism in Naples and Piedmont, and a little later in Spain. England's fleet preserved the little sea-coast country of Portugal from attack; and the tsar's sympathy for his Greek coreligionists held Metternich from aiding Turkey. Portugal and Greece were the only European lands to reap good from the widespread risings of this period.

American Progress.— Greater gain there was, however, outside Europe. The "Holy Alliance," successful in Spain, wished to restore monarchic control over revolted Spanish America. Here they failed. When Napoleon seized Spain (1808), the Spanish colonies, nominally loyal to the old Spanish dynasty, began to taste the sweets of economic and political freedom. They were powerfully influenced, too, by the success of the United States; and soon they began, one after another, to avow independence not only of Napoleon, but also of the mother country. The United States had recognized their independence. England had not done this; but now she interposed her sea-power to shield them against the proposed attack by the "Holy Alliance." England indeed urged the United States to join in a formal alliance to protect Spanish America. The United States chose to act separately, but it did act along the same line; in 1823 President Monroe's message announced that this country would oppose any attempt of the despotic powers to extend their political system to America. Thus was born a group of new nations. For more than 50 years, it is true, the best of the new states manifested anarchic tendencies; but before the close of the 19th century some of them began to make steady and promising progress in government and society. Their constitutions have been modeled generally upon that of the United States.

Before returning to Europe, brief attention should be given to the progress of the United States itself in the generation following the French Revolution. The Constitution of 1787 saved the 13 States of that time from falling apart into jangling, insignificant units, and gave the world an advanced type of federal government. Jefferson's peaceful «revolution» of 1800 marked the resumption of progress toward democracy and Americanization, which the aristocratic reaction just after the Revolutionary War had interrupted. The Louisiana Purchase (1803) doubled the territory of the country and confirmed its destiny as the home of a mighty continental nation. During the closing Napoleonic struggles, the contemptuous disregard of England for the rights of neutrals, together with the treacheries of Napoleon, involved America in war with England; but, beyond this, except for the enunciation of the Monroe Doctrine, the United States, busied with its marvelous growth at home, had kept free from foreign complications. At the moment of the European revolutions of 1820, the great American republic was entering on the 40 years of anti-slavery debate which preceded the Civil War.

Revolutions of 1830.— The year 1830 is one of the notable dates in the 19th century. In America the victory of Jackson had just marked a fresh advance in popular government; and the first labor union movement in America (the backbone of Jacksonian Democracy in the East) was agitating, in some places with successful strikes, for a 10-hour day in place of the dawn-to-dark day, for regulation of child labor so as to permit schooling during part of the year at least, and for a modern free State system of schools in place of the existing «pauper» schools for the poor. In England the First Reform Bill began its two-year struggle in Parliament. On the continent of Europe, revolution struck a new blow at the system of Metternich. This time the movement started in France, where the July Revolution replaced the divine-right Bourbon monarchy with the constitutional, bourgeois monarchy of the Orleanists. Explosions followed over Europe. The Belgians rose against their Dutch masters; the Poles against Russia; Italian risings seemed for a moment to have some chance in the Papal States and the duchies; and, while Russia and Austria were busied in Poland and Italy, liberal gains were secured in several German states. But soon Metternich, his hands free once more, set himself patiently to restore the old order in Germany. France, it is true, was lost to the «Holy Alliance,» and joined England in defending liberal Belgium against despotic intervention. But in the final result, France and Belgium were the only European gainers from this period. It was to take the third great «year of revolutions,» to sweep away Metternich's shattered system.

To appreciate in any measure the wonderful progress of the remaining two-thirds of the 19th century, it is needful to grasp conditions when the Victorian era began. It was still a small, despotic world, far more remote from the great, progressive world of 1900 than from the world of 1600. Civilization held only two patches on the globe,— western Europe and eastern North America. In the latter, the real frontier of the United States reached less than one-third the way across the continent, and politics and society were dominated by the slave power. Europe knew «Germany» only as a pious aspiration of revolutionaries, and «Italy» as a «geographical expression.» Metternich stood guard over central Europe. On the east hung Russia, an inert mass, in the chains of her millions of serfs. Under the contemptible Orleans monarchy, France was taking breath between spasmodic revolutions. England herself had only begun to stir under the long oligarchic rule of her landlord class. The rest of the globe hardly counted; a fringe of Australia held a convict camp; eastern Canada was a group of jealous, petty provinces, learning to agitate in disorderly fashion, for self-government; Spanish America, prostrate in anarchy, gave as yet little hope of the coming renaissance; Japan was to sleep a generation longer; while the two largest continents were undisturbed in their native barbarism, except for England's grasp upon the hem of India and South Africa.

England in the 19th Century.— In Europe, England was to lead the van of progress; and in England, almost alone in Europe, reform was to come without revolution. But the England of 1830 was still mediæval. During the great French wars from 1690 to 1815, except for the one development of ministerial government, England had retrograded politically and socially. Her society was marked by extreme inequalities between rich and poor, intensified by cruel class legislation; her government, superficially representative, had really fallen into the hands of a selfish landlord class; her boasted local self-government was intensely aristocratic; her Established Church was aristocratic and unspiritual. In the last half-century along with the industrial revolution had come a marvelous increase of population and growth of city life, calling imperatively for new adjustments; but the great Tory party met all calls for reform with sullen denunciation and repressive legislation which made free speech a crime.

Under the system of rotten and pocket boroughs, more than half the House of Commons were the appointees of less than 200 landlords, while most of the rest represented small fantastic constituencies. Thus, reform necessarily began with Parliament itself. This parliamentary reform was accomplished by three great measures; that of 1832 placed power in the hands of an intelligent middle class, the landed and mercantile interests; 35 years later, the Second Reform Bill (1867) gave power to the skilled artisan class of the towns; the bill of 1884 once more doubled the electorate; and the reform of 1918 made England a democracy with complete manhood and womanhood suffrage, and with abolition of all «plural voting.»

The Reform Bill of 1832 was followed at once by social reform, in response to the swelling tide of humanitarianism in literature and society. Legislation swept away negro slavery in the colonies, and the hideous white slavery of women and children in English factories and mines; reformed the barbarous and fantastic criminal code; abolished the worst abuses of the pauperizing poor-law; began the protection of workmen in factories against carelessness or wilful neglect of capitalists; gave women a few legal rights; adjusted taxation more equitably; swept away the corn laws and introduced the free-trade era; removed the press gang and brought in the penny post; enlarged the self-government of the colonies; and established a wonderfully efficient system of democratic self-government in cities at home. Subsequent political reform, despite the Irish difficulties after 1870, added to the rate of social reform. In particular should be noticed: (1) ballot reform and the elimination of corruption from politics; (2) the adoption of a broad school system; (3) the true democracy established in rural units by the local government bills of 1888 and 1894; (4) the complex industrial legislation; and (5) for dependencies where the nature of the population forbids self-government, the adoption of efficient, unselfish colonial administration, in which England has set an example for all world powers. Even India and Egypt, with their tremendous difficulties, were touched with new life. And the great provinces of the English-speaking colonies, Canada and Australia, were encouraged to organize themselves into two mighty federal states (1867 and 1901) — a movement fitly consummated after the Boer War by the generous establishment of the federal Union of South Africa (1909). Mr. Gladstone's defeat and retirement in 1895 checked internal reform for some 10 years; but by 1906 the Liberals had come into power again, under the vigorous leadership of Asquith and Lloyd George. As early as 1892 a famous Liberal platform had called for Irish Home Rule, Welsh disestablishment, sweeping reforms in taxation, old-age pensions, and, as a necessary step toward any reforms for the «mending or ending» of the lords. This program was now taken up in earnest. In 1911, after successive referendums and a three-year parliamentary struggle, the veto of the Lords was virtually abolished. Then the rest of the «New Castle program» was quickly put into law, along with the most advanced and comprehensive factory acts, workman's compensation acts, and social insurance acts yet known to the world — including insurance against unemployment. By Lloyd George's radical system of taxation, too, the money to wage this «war against poverty» was being drawn largely from that class of wealthy men who receive their wealth without rendering services to society in return. Other countries were moving, too, along like lines. But at the instant of success, all this fair promise of the new 20th century was blighted, in all European lands, by the devastation of the World War.

Revolutions of '48.— Meantime, on the Continent, the next great progress after 1830 came with the revolutions of 1848. A general explosion had been preparing; but again the signal was given by France. The Orleans monarchy had become reactionary; and the socialistic February revolution set up the Second Republic. March saw Metternich himself a fugitive, escaping from Vienna in a laundry cart, while thrones were tottering everywhere between Russia and Turkey on one side and England on the other. Even England trembled with a Chartist movement and the threat of an Irish rebellion. The kings of Holland, Spain, Denmark and Sweden made constitutional concessions. In Germany and Italy there were complex movements, working (1) for constitutional liberty and social reform within the several states; (2) for the union of the fragments of the German race into a nation; and (3) for the independence of Italians, Slavs and Hungarians held in subjection by Austria.

The third movement resulted in wars, out of which Austria finally emerged triumphant; and her victorious army was a ready tool to restore absolutism at home. In Germany the undisciplined Liberals had wasted opportunity, Austria dispersed the Frankfort National Assembly, and, after humiliating unready Prussia at Olmütz, restored the old confederation (1850). A year later (1851) the *coup d'état* of Louis Napoleon closed the revolution in France and prepared the way for the Second Empire of the next year.

But there had been great gains. Feudalism and serfdom were gone forever, even from Austria. Sardinia, Prussia and the minor German states kept their new constitutions. Switzerland had become a true federal republic upon the American type. Sardinia, by her sacrifices, and Prussia, in spite of the past mistakes of her timid government, were clearly marked out as the champions of Italy and Germany against Austria. Victor Emmanuel of Sardinia recognized his mission to unite and free Italy; and Prussia, so recently shamed, had statesmen who would see that next time she should be ready.

From 1850 to 1880.— The next 30 years saw not only the advance toward democracy in England, the victory of nationality and the abolition of slavery in the United States, the formation of the federal Canadian Dominion, on the American model, and the awakening of Japan under American constraint, but also a new federal German Empire, a united, constitutional Italy, a stable French republic, a constitutional Spain and a constitutional, federal Austria-Hungary. The period was one of «blood and iron.» Napoleon III, who had drawn England into the Crimean War (1854) to humiliate Russia, was himself drawn by the statesmanship of Cavour into the Austrian War of 1859 to help free Italy. Within a year after the resulting campaigns in Italy had closed, the American Civil War began; and before it ended, Bismarck had entered upon his trilogy of wars. In 1864 he robbed Denmark of the Schleswig-Holstein duchies, with the great harbor of Kiel for Prussia's projected navy, and so made trial of the new army he was at once to use (1866) in driving Austria out of Germany by the Six Weeks' War. The North German Confederation then formed was expanded into the German Empire by the Franco-Prussian War (1870–71), into which Bismarck next tricked the despairing ambition of the decaying French government. These struggles completed also the unity of Italy. In 1866 Italy recovered Venetia from Austria, and in 1870, when France could no longer interfere, it at last marched its troops into its ancient capital, Rome. Out of the Russian-Turkish War of 1877–78 a new group of Balkan nations was born, mainly Slav in blood, with at least the forms of constitutional government; but in the Treaty of Berlin, the short-sighted selfishness of England's Tory party, led by Disraeli, kept the Turk from being wholly driven out of Europe, and left smouldering the fatal embers of future and vaster conflagrations. Even for the vanquished, in the warlike period, reform grew out of war. The Crimean catastrophe struck the chains from Russia's serfs; the shock of defeat in 1859 and 1866 woke Austria to constitutional progress; only when Germany shivered the sham of the Second Empire did France enter upon true republican life; and it was in the ashes of her old social system that our own South found regeneration.

From 1880 to 1914 the Continent of Europe offers a marked contrast to the picture shown by the preceding period. Progress was mainly peaceful, until men began to dream that "blood and iron" were forever out of date. Except Russia, little Montenegro and European Turkey, all the monarchies of Europe had already become "constitutional," more or less after the English model. In none of the monarchies on the Continent, it is true, were the ministers so powerful, or so truly dependent on the people's will, as in England; and in some the formal constitutional monarchy merged into a practical despotism. Political advance consisted during the last period (1) in a growth of "ministerial responsibility"; (2) in a rapid extension of the franchise in almost all countries toward a manhood basis; and (3) soon after 1900, in a swift series of almost bloodless revolutions, which set up constitutional forms in Russia, Turkey, Persia and China, until for a time Siam was the only sovereign state on the globe without a representative assembly. Some of the Oriental revolutions were soon undone in part and in most European countries the actual administration of government remains highly aristocratic. On the other hand, in nearly every European land, the Socialists make a formidable political party with much weight in the national assembly; and nearly everywhere the people are training themselves, in compulsory school systems, for ultimate control.

International Relations Since 1880. Europe in Africa and Asia.— International relations since 1880 require brief statement. France, longing to recover her lost provinces from Germany in a war of revenge, drew close to Russia. Bismarck offended Russia by supporting Austria in the Balkans. Italy was angered by the French seizure of Tunis in 1881. Thus new combinations of the powers appeared. In 1882, Germany, Austria and Italy (all old enemies) leagued in the Triple Alliance; while a little later, France and Russia formally adopted a dual alliance. The Continent was thrown into two hostile camps and rested for the next 30 years under a crushingly burdensome armed peace. England, unwilling to join the Triple Alliance, as Bismarck wished, was left in a position her statesmen characterized as one of "splendid isolation." Soon, however, England began to see in Germany a rival in Africa and Asia (below) more to be dreaded than France. Germany's growing commercial activity, too, threatened England's supremacy in trade. Above all, German militarism was intensely repugnant to English democracy. On the other hand, England and France grew to a better understanding of each other, and in 1903 a standing arbitration treaty between them went far to prevent future jealousies. From that time England was properly regarded as allied with the old Dual Alliance — which now became the Triple Entente. To this alliance the small states of Europe gave their sympathies. On the other hand, Turkey fell away more and more from English influence into a practical dependency of Germany. And while the Dual Alliance grew into the Triple Entente, the old Triple Alliance was partly disrupted. Italy's acquisition of Tripoli (1911) canceled her old grievance against France; and then her ancient bitterness against Austria, because of Austria's retention of the Italian Trentino, began to drive her away from the central European powers.

In the 90's all these European arrangements were threatened by the active appearance, in the field of international politics, of two non-European powers. The Chinese War of 1894 revealed Japan as a modern and powerful state; and the Spanish-American War (1898) made it apparent that the United States had abandoned its exclusively American policy. Moreover, since about 1880, European politics had been merging more completely than ever before in world politics. Rhenish and Danubian questions for a time were dwarfed by mighty African and Asiatic problems. The earlier part of the 19th century, indeed, had been an age of expansion of civilization. The United States had quietly filled its borders from ocean to ocean with a homogeneous population. Russia had spread across northern Asia to the Pacific, and was reaching down in the Trans-Caspian region toward the Persian Gulf. And England had continued annexation of the keys to empire in waste spaces of the earth. These three were the world-powers. Far behind came France, with some important possessions in North Africa and some ancient claims in southeast Asia. Until 1884 Germany had no thought of colonial empire.

But about 1880 a new, conscious greed for colonial territory seized Europe. Africa, some Pacific islands and the helpless Asiatic empires of Persia, Turkey, Siam and China were the only unappropriated lands. There followed a swift, peaceful division of Africa. In 1880, only patches here and there on the coast were European; in 1891, except for the native states of Abyssinia, Liberia and Morocco, the continent was mapped out between European claimants. The three important African powers had come to be England, France and Germany, though Belgium, Spain, Portugal and Italy were also represented. England was far in the lead. Her ambition had been to unite her two main possessions, in the Nile Valley and in South Africa, by acquiring intermediate territory; but the Kongo Free State and German East Africa were thrust between too soon. France came second in extent of territory; but, except for Algeria and Madagascar, her districts were less valuable than those of England or Germany. France would have liked to join her holdings on the east and west of the continent; but she found English territory thrust in between. German ambition was frustrated in similar manner. Until the World War began the three powers had mutually stale-mated one another's attempts to dominate Africa.

The occupation of Asia by European states has proceeded more slowly, but has moved with increasing rapidity in recent years. England, Russia, Japan and France have been the chief powers concerned, though Germany has shown an active disposition to take a hand in any partition.

In 1894, Japan and China engaged in war over the control of Korea. With amazing rapidity, Japan overcame her bulky antagonist; but Russia, backed by France and Germany, stepped in to rob her of the fruits of her victory. Japan, owning not even one modern ship of war, was forced to yield — to spend all energies for the next 10 years in preparing for further conflict. Russia secured from China the right to extend her Siberian railroad through Manchuria, and in 1898 she also obtained the powerful fortress of Port Arthur. Germany and England then compelled China to grant them important districts, which, like the Russian acquisitions, seemed to command the heart of China and to doom that power to partition. In 1900 the Chinese resentment against «western barbarians» culminated in the Boxer massacres. The powers sent armies to rescue their beleaguered embassies at Peking; but, largely through the policy of the United States, no territorial indemnities were demanded. During the campaign, however, Russia occupied Manchuria, and, despite repeated solemn promises, it soon became plain that she meant to keep it. The powers apparently acquiesced; but when Russia in 1903 encroached also upon Korea, Japan foresaw danger to her own independence, and, in 1904, she began war. The struggle was tremendous, beyond all comparison with former wars; but Japanese victory was swift and overwhelming. That victory not only checked Russian aggression in the Orient, it also made plain that an Asiatic power had arisen able and disposed to enforce a Monroe Doctrine for Asia against the Western world. It was only one step more in the same direction when, at the opening of the World War in 1914, Japan captured the German holdings in China, under pledge of restoring them conditionally to China.

A Summary of Progress.— Historically measured, the 19th century extends from 1789 to 1914 — from the French Revolution to the World War. That «wonderful century» of progress transformed the world as no previous millenium had ever done. Its three mighty agents have been democracy, humane sentiment and scientific invention. The growth of democracy in politics, and, in less degree, in industry, has been the special theme of the latter part of this article. The gentler spirit of recent society, likewise touched upon, has abolished slavery and serfdom, ameliorated law and given birth to a «war upon poverty,» with zealous and intelligent effort to lessen misery and sin. But the most marvelous phase is the scientific advance. Ancient science was the plaything of philosophers: to-day science has become the servant of mankind.

The *rate* of this form of progress is roughly indicated by the records of the United States Patent Office. From the inauguration of Washington to the War of 1812, patents for new inventions averaged less than 80 a year. From 1812 to 1820 they rose to nearly 200 a year, and in 1830 — the year of a new democracy in politics and industry — the number was 544. Twenty years later the 1,000 mark was passed, and in 1860 the number was nearly 5,000. These inventions mostly saved time or tended to make life more comfortable or more attractive. Detailed treatment, with technical features, belongs to special articles such as may be found elsewhere in THE AMERICANA. Three groups only will be mentioned briefly here. The remarkable series that underlay the industrial revolution, just before 1800, has been partially surveyed above, and we may now add that America, with its vast spaces and with its rivers for almost its only roads, soon modified the steam engine, one invention of that series, into an engine for locomotion by water, giving the world the steamboat. The next great group belongs to the second quarter of the century. Just after 1830, in both England and America, the steam railway became a success. English friction matches (1837) made the first improvement on prehistoric methods of fire-making, and soon afterward illuminating gas for city streets began to improve public morals. Stern-wheel propellers replaced the old side-wheel arrangement for steamers, and in 1838 the *Great Western* established steam navigation across the Atlantic. In 1839, in France, Daguerre began photography; and still earlier French chemistry had taught the world to can foods. In America, the McCormick reaper (1831), with the quickly following self-binders, mowers and other like machines, made it possible to apply horse power to agriculture in other ways beside preparing the soil; the year 1838 saw the invention of the steam hammer and the successful application of anthracite coal to smelting iron; the anæsthetic value of ether was discovered for the relief of suffering humanity in 1841; the magnetic telegraph, invented in 1835, became a practical working success in 1844; Howe's sewing machine (1846) relieved the overburdened housewife; and the long line of improvements upon it, including machinery for sewing leather, soon revolutionized tailoring and created new industries in clothing factories and shoe manufacturing; and in 1847 the rotary printing press marked the dawn of a new intellectual day. The period of «blood and iron» (1854–78) saw a circle of inventions in Europe and America relating largely to warfare; and then came the third group to be considered here, replacing the age of steam by the age of electricity and transforming the face of the world and all habits of life once more before the eyes of men still under middle age. Here belong electric lights and the electric street railway, telephone and phonograph, wireless telegraphy, automobile and auto truck (with a «horseless age» for city and farm), submarine and aeroplane, along with such a transformation of all earlier machines and processes of production as to make those of 1850 quaint objects for a museum of natural curiosities.

It remains to mention, for this last period, *the new relation of science to medicine.* In the 80's. Pasteur broke the way, proving the germ theory of disease and inventing methods of inoculation against some of the most dreaded forms, like hydrophobia. Devoted disciples followed in his footsteps. During the American occupation of Cuba after the Spanish-American War, Major Walter Reed showed that ordinary malaria and the deadly yellow fever alike were spread by the bite of mosquitoes. In like manner it has been proved that certain fleas, carried by rats, spread the bubonic plague. In 1903 Dr. Charles W. Stiles proved that the inefficiency and low vitality of the «poor whites» in the southern United States were due to the parasitic hookworm. The special causes of typhoid and tuberculosis have become well known; and the germ that causes infantile paralysis has been discovered. Each such discovery has enabled men to fight disease more successfully. It is not improbable that in the not distant future all deadly contagious disease may be practically banished from the earth. Between 1850 and 1900 the average human life in civilized lands had been lengthened by a fourth, and population has been trebled.

This larger and better life of the 20th century, too, is bound together, for good and for ill, in *a new human solidarity*. The enlarged world of 1900 is more compact than the small world of 1800. Ox-cart and pack-horse have been replaced as carriers by long lines of cars swiftly moving thousands of tons of all kinds of freight across continents. New methods of banking make it possible to transfer credit with magical quickness between distant portions of the earth; and, to say nothing of telegraphy, lines of communication are so organized that it costs no more to send a letter or parcel around the globe than to send it around the nearest street corner. The Minnesota farmer's market is not Minneapolis, but the world. The sheep raiser in Australia, the Kansas farmer, the New York merchant, the London banker, are parts of one industrial organism. All this solidarity means *one more revolution in industry*. The age of small individual enterprise has given way to an era of vast consolidation of capital and management — department stores, mighty corporations, huge trusts, flouring centres like Minneapolis, meat-packing centres like Chicago, money centres like Wall street. And this consolidation has brought incalculable saving of wealth in economy of management and in utilization of old wastes into by-products. The new unity of society, too, has its *moral* side. Any happening of consequence is known within the hour in London, Petrograd, Pekin, New York, San Francisco, and, within a day, in almost every hamlet where civilized men live. A world opinion shapes itself, in ordinary times, as promptly as village opinion could be brought to bear upon an individual citizen a century ago.

Even before the horrible catastrophe of the World War, it was plain enough that *all this modern progress had a darker side*. The industrial organization produced wealth with gratifying rapidity, but failed to distribute it equitably. The world had become rich; but multitudes of workers remained ominously poor. Even in the most democratic countries about nine-tenths of the increased wealth was held by one-tenth the population, while at least two-tenths of the people were reduced to a stage of poverty that imperiled both health and decency. The apex of the social pyramid contains real captains of industry, but it contains also pirates and parasites. Service to society has less to do with its revenues than plunder and privilege have. The broad base of the pyramid contains multitudes whose poverty results from physical or mental or moral lack; but it contains other multitudes of willing, hard-working, sober men and women now denied a chance at comfortable and happy life. And this modern poverty is harder to bear than that of earlier times because it is less necessary. Then there was little wealth to divide. Now the poor man is jostled insultingly by ostentatious affluence and vicious waste. These were the conditions that summoned enlightened thinkers and statesmen to a hopeful «war upon poverty» when the calamitous World War of 1914 set back indefinitely the hand of progress.

For modern society contained other poison more potent even than those industrial ills. All «civilized» nations, on occasion, still showed callous disregard of humane principles and of just dealing in their relations with barbarous and weak states. And among themselves the civilized peoples were still in the imperfect «national» stage,— a stage far advanced upon the city or tribal or class organization of earlier centuries, but insufficient for the new needs of humanity, forbidding all approach to world patriotism, fruitful of international misunderstandings and rivalries and hatreds and of a low and blasphemous international morality which permits a strong power, for its selfish ends, scornfully to tear up the most solemn treaties as «scraps of paper.» Semi-civilized peoples are equipped with all the modern engines of destruction. And in particular, in Germany, leader in civilization as she was in some respects, a curiously surviving feudal class had dominated society and had taught insistently and insidiously an intensified Bismarckian philosophy of brute force,— the doctrine that the measure of a people's virtue is its military prowess and that victory in war justifies all means. Thus all modern progress had long been threatened, to the deeply observant, by the brooding menace of annihilating war armed with all the inventions of the new scientific age.

To lessen this peril, the world had recourse to The Hague Congresses of 1899 and 1907 and to a long series of standing arbitration treaties for the judicial settlement of future disputes between nations. This movement held much of promise: but, ominously, all proposals at The Hague meetings for disarmament, or for the limitation of armaments, fell before the opposition of Germany. Between nations armed to the teeth, arbitration treaties backed by no international police it was plain could have little more lasting value than laws have between armed desperadoes in a district without a sheriff.

Still, despite all warnings, the mighty struggle that began in the summer of 1914 amazed the world. The conflagration spread swiftly until the two central powers, Germany and Austria, with their two dependent allies, Turkey and Bulgaria, were encircled by a ring of 10 hostile nations. The various phases of the mighty conflict are treated elsewhere in this work under appropriate headings. (See WAR, EUROPEAN). From the historian's viewpoint, this much is clear: the conclusion of the war must mark the end of one age and the beginning of another. That new age must begin under indescribable handicaps. If ultimately it prove better than the age just gone, it will be only because of some happy outcome from the stern world-wide determination already aroused that some new way shall be found to prevent future wars. A confederation of nations to enforce arbitration, from the prophetic forecast of poets, has suddenly become the most pressing practical problem of statesmen. This is the ray of hope that breaks from the war clouds over Europe.

Bibliography.— Within the space at command, no detailed bibliography is possible. Since the dawn of the scientific study of history, writers have shunned the attempt to cover the complex field of modern history except in co-operative «series.» Of such series the most important in English are 'The Cambridge Modern History,' edited by Ward (1903–14, 12 vols.); 'Periods of European History,' edited by Hassall (1890–92, 8 vols., of which the last 5 belong to our period). Hazen's 'Europe Since 1815' (1909); Andrews' 'Historical Development of Modern Europe' (1896); Fyffe's 'Modern Europe to 1878' (1884), and Seignobos' 'Europe Since 1814' (1899) deal with the 19th century. For further references the reader may consult the special bibliographies at the close of the articles on leading countries and movements.

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HISTORY, Great Events of. The following list gives only those important events which have affected or changed the subsequent history of nations. The cross-reference will refer the student to the special information concerning these epoch-making occurrences, and the following special articles may also be consulted. History, Ancient; Mediæval; Modern; Wars of the World; Peace Treaties; Republics, History of; Explorations in the 19th Century; Polar Research; Jewish History; Crusades; Cromwell; Gunpowder; Thirty Years' War; Seven Years' War; Napoleon; Waterloo, Battle of; Crimea; America, Discovery and Colonization of; Discoveries of America to 1562, Spanish and Portuguese; Colonial Wars in America; United States, Wars of the: Declaration of Independence; Slavery in the United States; Confederate States of America; Monroe Doctrine; United States —The American Revolution; The War with France; War of 1812; Mexican War; Slavery; Causes of the Civil War; Reconstruction; War with Spain, etc.; Treaties of the United States with Foreign Nations; The Eastern Question; The Oregon Question; Emancipation in Latin-America; Pekin, Siege of; Boers; South African War; Riel's Rebellion; War, European, etc.

B. C.

1277. Exodus of the Children of Israel from Egypt.
1111. Mariner's compass (q.v.) discovered.
753. Rome (q.v.) founded.
603. Geometry and maps (q.v.) first used.
551–479. Confucius (q.v.) flourished.
538. Fall of Babylon (q.v.).
490. Battle of Marathon.
336. Accession of Alexander (q.v.); Grecian Empire.
63–44. Cæsarian era; Britain invaded; Gaul conquered.

A. D.

33. The crucifixion of Christ (q.v.).
451. Battle of Chalons.
570–632. Mohammed (q.v.) flourished.
800. Charlemagne (q.v.), emperor of the West.
967. Egypt conquered by the Turks.
1066. Battle of Hastings in England.
1095. Crusades (q.v.) in Holy Land begun.
1234. Gunpowder (q.v.) first used by Genghis Khan.
1453. End of the Roman Empire in the East.
1455–85. War of the Roses in England.
1492. Columbus discovered America.
16th Cent. Period of Reformation (q.v.) in Europe.
1588. Destruction of the Spanish Armada.
1618–48. Thirty Years' War (q.v.).
1619. Beginning of slavery (q.v.) in America.
1642. Beginning of the Civil War in England.
1627. Barometer and thermometer (qq.v.) devised.
1648–52. Civil war of the Fronde in France.
1642–1724. Newton (q.v.) discovered gravitation.
1713. Peace of Utrecht Ending War of Spanish Succession (q.v.).
1741–48. War of the Austrian succession.
1756–63. The Seven Years' War (q.v.).
1776. Declaration of Independence (q.v.).
1789–1802. French Revolution.
1804–15. Napoleon (q.v.), emperor of France.
1812–14. War of 1812 (q.v.).
1815. Battle of Waterloo (q.v.).
1819. Electro-magnetism discovered.
1821–29. Greek war of independence.
1831–39. Belgian war of independence.
1845–48. Mexican War (q.v.) with the United States.
1853–55. Crimean War.
1857–59. Indian mutiny and war.
1861–65. Civil War (q.v.) in United States.
1863. Battle of Gettysburg (q.v.).
1866. Laying of first Atlantic cable.
1868–99. Cuban war of independence.
1870–71. Franco-Prussian War (q.v.).
1877–78. Russo-Turkish War.
1883–84. War in the Sudan.
1894. War between Japan and China.
1895. Roentgen discovery of X-rays (q.v.).
1897. War between Turkey and Greece.
1898. Spanish-American War began.
1898. Hawaii (q.v.) annexed to the United States.
1899. Peace conference at The Hague (q.v.).
1899–1900. War between England and Boers.
1902. First Anglo-Japanese alliance. See Anglo-Japanese Treaties.
1903. Panama Canal Treaty signed. See Panama Canal.
1903. Pacific cable completed. Invention of human flight.
1904–05. War between Japan and Russia, terminated 5 Sept. 1905 by Treaty of Portsmouth (q.v.). See Manchuria.
1905. Second Anglo-Japanese alliance.
1906. Earthquake and fire, San Francisco, Cal. See Earthquake.
1908. Restoration of the constitution in Turkey. The American battleship fleet sailed around the world.
1909. The North Pole discovered 6 April. Union of South Africa, 31 May.
1910. Republic established in Portugal.
1911. The Italian-Turkish War began. President Diaz of Mexico expelled. The South Pole discovered 14 December. China proclaimed a republic.
1912. Balkan War. Wreck of the *Titanic*, 14 April.
1913. Rebellion in Mexico. Peace palace at La Hague dedicated.
1914. Great European War began.
1915. Wireless communication established between United States and Japan. *Lusitania* sunk by German submarine, 2 May.
1916. American troops enter Mexico on punitive expedition against outlaws. *Deutschland*, German commercial submarine crosses and recrosses the Atlantic. *U*-53, German war submarine, enters Newport, R. I., and departing sinks five commercial vessels off Nantucket lightship.
1917. United States enters European War.

HISTORY, Logic of. The relation of history to the problems of the philosopher has been mostly confined to those questions which are treated in the philosophy of history. The object of this discipline is to interpret the meaning of mankind's historical development and to comprehend the progress of humanity in the setting of a metaphysical system. It is only in recent times that philosophy has recognized clearly the importance of an entirely different relation. If the philosopher studies in the science of logic the ways of thought and the special methods by which the different special sciences are able to reach the truth it must be logical and thus, ultimately, a philosophical task to examine the methods of historical investigation. The special schemes of the historian's technique belong to historical science proper. But as soon as the attitude which the historian has to take toward the world is in question, we stand before a logical problem which is most nearly connected with the general problem of the meaning of truth. A rich literature devoted to this circle of problems has grown up in late years, partly through the activity of philosophers and psychologists, partly from the interests of historians and economists themselves.

Of course, it is possible to take the skeptical attitude and to deny the existence of a particular problem here. We can say that all science has the same kind of task, and that the logical problems are thus not other for history than for the natural sciences. Yet this attitude may lead to two different standpoints. The first is the most popular one. From that it would appear that history is not a real science at all. It collects a mass of material just as the zoologist collects his specimens; but that kind of treatment which makes zoology a real science, the study of the common characteristics and of the underlying laws, is not in question for the historical material. Instead of this an art enters into play, the art of historical presentation. The works of the great historian are thus in first line works of art parallel to the great epic narratives, with only the difference that the epic poems follow the lines of imagination while the historian reconstructs the facts as they may have happened. Scientifically history would thus stand on the lowest level, as a mere collection of facts without that real scientific treatment which makes the value of the other sciences. The best which can be hoped, then, is that it may be brought to a kind of scientific height by introducing as much as possible the results of other sciences such as physics, biology, anthropology, geo-physics, etc., into the explanation of historical happenings. The influence of climate, of race disposition, of technical inventions, and so forth, then become predominant in the scholarly treatment of historical events. It may be said that this low opinion of the pure scientific character of history has been prevalent throughout the whole history of science.

But those who consider the natural sciences as the only type of real scientific work may be led, and have been led frequently in recent times to still another standpoint. They may say that history has the greatest possibility of being a full-fledged science. The only step it has to take is that from the merely descriptive to the law-seeking attitude. The real task of the historian, they say, would be to find the common features which belong to the growth of every nation and to the political and social, artistic and scientific, economic and religious movement of the different periods and of the different communities. As long as isolated processes are described, history indeed remains on a pre-scientific level, but as soon as we recognize characteristic types of development, we reach general laws like those of the biologist or the chemist. The interest concentrates itself then on the psychological factors which molded the fate of the nations, and especially the life of the masses becomes a true historical agency. That which is unique then becomes insignificant and accidental as compared with the great typical processes which repeat themselves under similar conditions in the most different countries. A kind of natural science of historical nations thus becomes the logical goal.

Those modern movements, however, which have forced the problems of the logic of history to public attention object to both these standpoints because they refuse to admit the first presupposition. They deny that the natural sciences are the only type of a real science. They claim, rather, that this is a prejudice which has been suggested to the world by the overwhelming influence of the Aristotelian logic on the one side, and the impressive triumphs of natural science on the other. They hold that there exists two types of scientific thought in principle commensurable, and that the historical way of thinking is in its importance and in its logical right perfectly co-ordinate with naturalistic thought. Yet here again a variety of standpoints have been taken.

The simplest presentation of this doubleness of logical method is offered by those who hold that the whole separation is to be deduced from the doubleness of the logical attitude. They say that we can take with reference to everything in the universe either the attitude of interest in the general law or the attitude of interest in the particular thing. The one interest can never be substituted for the other. In the one case the particular object is for us only a sample illustration for a general relation. We seek the law which expresses that relation and inhibits therefore the interest in the special chance case which is before us. That is the attitude of the naturalist. On the other hand we may give our whole attention to the particular object before us in its uniqueness, and there is no doubt that our practical interests of life force on us just this attitude. Our earth may be astronomically not more important than any other planet, but our practical interest belongs to this planet alone. Our friends may be to the biologist not more instructive than any other group of organisms, but for our friendship those particular men have their unique position and cannot be replaced by other chance copies. To develop systematically this interest in the particular is the function of the historian, and anything which has its particular existence is possible historical material. Yet it is evident that no science can have the task of describing every particular pebble on the beach. There must be a principle of selection, and this is given in the reference to our values. The men who have relation to that which is valuable in the world, to the development of state and law, of art and science and religion, are to be selected for the historian's account. And this ultimate reference to values binds the particular objects together, while it is evident that the law of natural science brings the facts under a point of view under which they have no special value at all, but are indifferent objects of theoretical observation. The antithesis is thus complete. The naturalist seeks the general, the historian seeks the particular. The naturalist refers everything to the law, the historian everything to the value. Both groups of interest create logically independent systems of knowledge. Their difference is thus in no way a difference of material, as there is nothing in the world which cannot be considered from both points of view. The sun which the astronomer studies in relation to the astronomical laws as a chance case of a general relation which holds for myriads of suns may be at the same time the object of interest for those who ask about the development of this one particular sun which gives us light. And on the other hand, even the Napoleon of the historian may be brought under the laws of biology from the standpoint of the naturalist.

Others who welcome this sharp separation feel doubtful whether it is really the logical attitude which determines the difference and not the content. They claim that it is not true that natural science has to deal with laws only. Natural science may very well give its attention to particular objects too, and the development of our sun or our earth or our mankind is not history but natural science. The true difference, they say, lies rather in the doubleness of the objectifying and the subjectifying attitude.

The sun and earth are for us all objects, but men and their work can be considered in a double way. We can consider our neighbors as objects, as phenomena which we describe and explain, but we can consider them also as subjects of will which we understand and interpret and appreciate, and this doubleness of attitude reaches over the whole of mankind. Wherever there is will, there the object can be taken as a subject and it is claimed that the work of the naturalist is the study of the world in so far as it is conceived as a system of objects, while the study of the historian is the world in so far as it is conceived as a system of will relations. Only subjects of will would thus be able to enter into history at all. And the task of the historian is to understand the systematic relations between the purposive actions. The naturalist starts from the objects of his perception and seeks their causes and their effects. The historian starts from those will demands which reach him as the political, legal, artistic, scientific, economic, religious demands of his social world, and he seeks to interpret them by connecting them with the purposes of the past. The naturalist explains, while the historian interprets intentions and links the will purposes into a connected unity.

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HISTORY OF ECONOMICS. See ECONOMIC HISTORY.

HISTORY OF EDUCATION. See EDUCATION, HISTORY OF.

HITCHCOCK, hĭch'kŏk, **Charles Henry,** American geologist: b. Amherst, Mass., 23 Aug. 1836. He was a son of Edward Hitchcock, geologist (q.v.) He was graduated from Amherst College in 1856, was assistant State geologist of Vermont in 1857–61, State geologist of Maine 1861–62 and of New Hampshire 1868–78. In 1868 he was appointed professor of geology in Dartmouth College, retaining this position until 1908, when he became professor emeritus. In connection with his survey of New Hampshire, he maintained, during the winter of 1870, a meteorological station on Mount Washington, the earliest high-mountain observatory in the United States. He became known as a compiler of geological maps, and for his investigations regarding the geology of the crystalline schists, ichnology and glacial geology. The location of the terminal glacier in the United States was first suggested by him. His later work has been in connection with the Geological Survey of Vermont, particularly the glacial geology, and with the New Jersey Geological Survey, studying the Trianic footmarks. He claims that the animals that made the tracks were largely "birds with teeth" and not dinosaurs. He was a founder of the Geological Society of America, and in 1883 vice-president of the American Association for the Advancement of Science. His publications include 'Elementary Geology' (1861, with E. Hitchcock); 'Mt. Washington in Winter' (1871); and a 'Report on the Geology of New Hampshire' (1873–78), with folio atlas, his most valuable work; and 'Hawaii and its Volcanoes' (1909; 2d ed., 1911).

HITCHCOCK, Edward, American Congregational clergyman and geologist: b. Deerfield, Mass., 24 May 1793; d. Amherst, Mass., 27 Feb. 1864. He was principal of the academy in his native place 1815–18; pastor of the Congregational Church in Conway, Mass., 1821–25; professor of chemistry and natural history in Amherst College 1825–45 and president of Amherst College and professor of natural theology and geology 1845–54. He was appointed State geologist of Massachusetts in 1830, of the First District of New York in 1836 and of Vermont in 1857. In 1850 he was commissioned by the government of his native State to examine the agricultural schools in Europe. His life was in a great measure identified with the history of Amherst College. Connected with it almost from the beginning, in his own presidency he procured for it buildings, apparatus and funds to the amount of $100,000, doubled the number of students and established it on a solid pecuniary as well as literary and scientific basis. His earliest scientific publications were the 'Geology of the Connecticut Valley' (1823), and a 'Catalogue of the Plants within Twenty Miles of Amherst' (1829). Later works were 'Lectures on Diet, Regimen, and Employment' (1831); 'Lectures on the Peculiar Phenomena of the Four Seasons' (1850); 'Reports on the Geology of Massachusetts' (1833–35–38–41); 'Illustrations of Surface Geology' (1857); 'Elementary Geology,' which passed through 25 editions in America, and one-third of that number in England; 'Religion of Geology and its Connected Sciences' (1851); and 'Reminiscences of Amherst College' (1863). Dr. Hitchcock suggested as well as executed the geological survey of Massachusetts, the first not only in the long series of scientific surveys in the United States, but the first survey of an entire State under the authority of government in the world. He was the first to give a scientific exposition of the fossil footprints of the Connecticut Valley, and with him ichnology as a science began.

HITCHCOCK, Ethan Allen, American soldier: b. Vergennes, Vt., 18 May 1798; d. Sparta, Ga., 5 Aug. 1870. He was a grandson of Ethan Allen (q.v.), and was graduated at West Point in 1817, entering the corps of artillery as a third lieutenant. In 1829 he became the military commandant of the corps of cadets, in which office he continued until 1833. He served in Florida against the Indians, and in the war with Mexico, where he received two brevets, one as colonel and another as brigadier-general. In 1855 he printed for private circulation a pamphlet in support of his opinion that genuine alchemy was not an art for making gold, but that the alchemists were students of man, whose perfection was symbolized by their «philosopher's stone.» He subsequently published ‘Remarks upon Alchemy and the Alchemists’ (1857); ‘Swedenborg a Hermetic Philosopher’ (1858); ‘Notes on the Vita Nuova of Dante’ (1866).

HITCHCOCK, Ethan Allen, American politician: b. Mobile, Ala., 19 Sept. 1835; d. Washington, D. C., 9 April 1909. Was in mercantile business at Saint Louis, Mo., 1855–60, then went to China to enter a commission house, of which firm he became a partner in 1866. In 1872 he retired from business, in 1874 returned to the United States, and in 1874–97 was president of several manufacturing, mining and railway companies. He was appointed Envoy Extraordinary and Minister Plenipotentiary to Russia in 1897 and in February 1898 Ambassador Extraordinary and Minister Plenipotentiary, the first Ambassador accredited from the United States to the court of Russia. In 1898 he was nominated and confirmed as Secretary of the Interior, and held that position till 4 March 1907.

HITCHCOCK, James Ripley Wellman, American art critic: b. Fitchburg, Mass., 3 July 1857. He was graduated at Harvard in 1877, and in 1882–83 made long journeys in the West, Mexico and Northwest as special correspondent of the New York *Tribune,* was art critic of the *Tribune* 1882–90. He was literary adviser to D. Appleton and Company in 1890–1902, and after 1902 to Harper and Brothers. He has written much upon American history, outdoor life and literary topics as well as art. He has lectured extensively upon artistic and literary subjects. He has written ‘The Western Art Movement’ (1885); ‘A Study of George Inness’ (1885); ‘Madonnas by Old Masters’ (1888), the text to photogravures; ‘The Future of Etching’; ‘Some American Painters in Water Colors’; ‘Etching in America’; ‘Notable Etchings by American Artists’; ‘Thomas De Quincy: a Study; ‘The Louisiana Purchase and the Building of the West’ (1904); ‘The Lewis and Clark Expedition’ (1905). He edited ‘The Life of an Artist, by Jules Breton’; ‘The Last Words of Thomas Carlyle’; ‘The Art of the World Illustrated in the Paintings, Statuary and Architecture of the Columbian Exposition, with an introduction and much other text’; ‘The Story of the West Series,’ including ‘The Story of the Indian’; ‘The Story of the Mine’; ‘The Story of the Cowboy’; ‘The Story of the Railroad’; ‘The Story of the Soldier’; and ‘The Story of the Trapper,’ with introductions; ‘Recollections,’ by Richard Henry Stoddard; ‘The Trail-Makers, a Library of History and Exploration’; ‘Decisive Battles of America,’ and other works.

HITCHCOCK, Roswell Dwight, American Congregational clergyman: b. East Machias, Me., 15 Aug. 1817; d. Somerset, Mass., 16 June 1887. Graduated from Amherst College in 1836 and from the Andover Theological Seminary in 1838, he also studied at Halle and Berlin (1847), in 1845–52 was pastor of the First Congregational Church at Exeter, N. H., and in 1852–55 professor of revealed religion in Bowdoin College. In 1855 he became professor of church history at the Union Theological Seminary, of which institution he was elected president in 1880. He became president of the Palestine Exploration Society in 1871, and vice-president of the American Geological Society in 1880. An editor of the ‘American Theological Review’; he wrote ‘The Life, Character, and Writings of Edward Robinson’ (1863); ‘Complete Analysis of the Holy Bible’ (1869); and ‘Socialism’ (1879), With Eddy and Madge, he compiled ‘Carmina Sanctorum’ (1885); and ‘Eternal Atonement,’ a volume of sermons, appeared in 1888.

HITOTSUBASHI, Japanese statesman and party leader: b. 1837; d. 1902. Son of Nariaki Daimyo of Mito (q.v.), and naturally a supporter of the Doctrine of Mito (q.v.), he appeared as the leader of the party opposed to the open door in Japan. He is known as Keiki (Kā'kē), the pronunciation of the Chinese characters representing his name, and as Yoshinobu, his real name. The cognomen Hitotsubashi he obtained when he was adopted into the feudal house of that name in 1848. He became guardian of the young Shōgun in 1863, a position that gave him great prominence in the affairs of Japan at a time when the nation was at the parting of the ways. He is known as «the last of the Tycoons,» or the last Shōgun. His real title was Yoshinobu Tokugawa, Prince Tokugawa. He was heir of the house of Hitotsubashi, and as such eventually became Shōgun. He came of a long line of illustrious ancestors which had helped to make the history of Japan for over 300 years. Yoshinobu became Shōgun in August 1866, and the following year, notwithstanding his family tradition, he presented a memorial to the emperor advising to call the barons together to discuss the «open door question» and the relation of Japan to foreign countries and civilization. He also took steps to have all the government of the country centred in the emperor. But the Shōgunate party which he represented opposed this and open war broke out between the emperor and the Shōgunates. Yoshinobu, in the difficult position of owing allegiance of a traditional and religious character to the emperor and leadership to his own family and party, decided to follow the will of his famous father, Nariaki (q.v.), and be faithful to the emperor at all cost. In the war the party of the emperor won out and Yoshinobu retired to private life still retaining the favor and confidence of the court by whom he was recognized as Prince Tokugawa. His princely residence was one of the conspicuous objects by the Kioshikawa Gate in Tokio. Consult Okuma, Count Shigenobu, ‘Fifty Years of New Japan’ (translated into English by Marcus B. Huish, London 1909).

HITTELL, Theodore Henry, American historian: b. Marietta, Pa., 5 April 1830. In 1852 he was admitted to the bar at Cincinnati, in 1855 removed to California, in 1855–61 was connected with the *Bulletin and Times* of San Francisco and from 1862 practised law. He was State senator in 1880–82. He wrote a ‘History of California,’ his chief work; and compiled ‘The General Laws of California,’ known as ‘Hittell's Digest,’ and ‘Hittell's Codes and Statutes of California’; ‘Review of Goethe's Faust’; ‘Adventures of James Capen Adams — California Grizzly Bear Hunter.’

HITTITES, hĭt'īts, the name of several peoples mentioned in the Old Testament, and in Egyptian and Assyrian inscriptions. In the Old Testament the name is applied to three more or less distinct groups, namely, the «children of Heth» from whom Abraham purchased a burying-place; a people or group of peoples which inhabited Palestine before the Hebrews and resisted their invasion; a kingdom in northeastern Syria, with which Solomon formed marriage alliances. The first group dwelt around Hebron in southern Palestine, and the Hittites mentioned in connection with David, of whom the chief was Uriah, may be their descendants. The second group of Hittites dwelt among the mountains of central Palestine, and the third group, united in some sort of empire, had their seat still farther north. Of this Hittite empire we learn more from the Egyptian and Assyrian records than from the Old Testament. The Heta according to the hieroglyphic inscriptions, offered a vigorous resistance in northern Syria to the Egyptian king Thutmosis III (18th dyn.: c. 1560 B.C.), and to his successors of the 19th dynasty, Sethos I, Rameses II and III, c. 1350–1200 B.C. Carchemish, Kadesh and Hamath were among their chief cities. The cuneiform inscriptions contain notices of a people called Hatti who frequently fought with the Assyrians from the time of Tiglath-pilesar I (c. 1100 B.C.), till that of Sargon II (721–704 B.C.), after which they are no more heard of. The Hittite monuments and inscriptions which have been found in Carchemish, Hamath and neighboring places, as well as throughout Asia Minor, appear to belong to the Assyrian period.

HITTORFF, Jacques Ignace, French architect: b. Cologne, 1792; d. 1867. He studied his profession in Paris under Percier. In 1819–25 he traveled in England, Germany and Italy, making a special study of the Greek ruins of Sicily. He became architect to the king in 1825 and in conjunction with Lepère designed the church of Saint Vincent de Paul, Paris, to which he applied the results of his studies of Greek polychromy. The Place de la Concorde has two fine fountains and other embellishments from his hand, likewise the Bois de Boulogne, the Champs Elysées and other squares and boulevards. He was appointed Surveillant-General du Conseil des Bâtiments in 1864. Among his publications may be mentioned ‘Architecture antique de la Sicile’ (1830); ‘Architecture moderne de la Sicile’ (1835); and ‘Architecture polychrome chez les Grecs’ (1851) — all works of standard and permanent value.

HITZIG, Ferdinand, German theologian: b. Hauingen, Baden, 23 June 1807; d. Heidelberg, 22 Jan. 1875. He was educated at Heidelberg, Halle and Göttingen. He went to Zürich in 1833 as professor of theology, where he remained until 1861, when he returned to Heidelberg. He was quite a voluminous writer on the Old Testament, composing commentaries on the Minor Prophets (1838); Jeremiah (1841); Ezekiel (1847); Ecclesiastes (1847); Daniel (1850); Song of Solomon (1855). He made a translation of the Psalms in 1835. His ‘Prophet Jesaia übersetzt und ausgelegt’ (1834), gave him a high place among Biblical scholars of his day; as also the ‘Exegetisches Handbuch zum alten Testament,’ which contained many of his commentaries. He also wrote on the New Testament, and his general work ‘Geschichte des Volkes Israel’ (1870), marked an important advance in Biblical archæology. Consult Cheyne, ‘Founders of Old Testament Criticism’ (London 1893), and the biography by H. Steiner (Zürich 1882).

HIVE-BEE. See HONEY-BEE; BEEKEEPING.

HIVES. See URTICARIA.

HJÖRLEIFSSON, Einar, Icelandic novelist and journalist: b. Godhdalir, Skagafjardharsysla, 6 Dec. 1859. He is the best known of the short story writers of his country. He spent the years 1885 to 1895 in Canada, editing the weekly *Heimskringla* at Winnipeg (1886–88) and the weekly *Lögberg* (1888–95). Since 1910 he has been receiving a regular stipend from the government of Iceland for his literary work. His best collection of short stories is probably ‘Vestan hafs og austan’ (‘West of the Sea and East,’ 1901), which contains three stories (‘Vonir,’ ‘Litli Hvammur’ and ‘Ördhugasti hjallinn’), none of which has been translated into English. Those wishing to read specimens of his work should consult *The International* (New York September 1914), and *The American-Scandinavian Review* (New York May 1917).

HOACTZIN, hō-ăkt'zĭn or -ăk'zĭn, a singular South American bird (*Opisthocomus cristatus*) of the size of a pheasant. It is brown streaked with white, and the head has a movable crest. It is interesting principally from the extraordinary way in which the fledglings, as soon as they leave the nest (in a tree), scramble about the branches by aid of their wings used like hands, by reason of the fact that they have a temporary claw on both the index and pollex. This is an interesting reminder of primitive methods of progression in birds, reminding one of how the archæoptery utilized its fingers as well as its feet. The food of these birds is mainly leaves and fruit; and a strong musky odor is given off by the adults, so that in British Guiana they are called «stinking pheasants.» They nest in trees in companies much after the manner of herons. C. William Beebe has given description and pictures of the hoactzin in his book ‘Our Search for a Wilderness’ (New York 1910), and in the publications of the American Museum of Natural History.

HOADLEY, hōd'lĭ, **George,** American lawyer: b. New Haven, Conn., 31 July 1826; d. Watkins, N. Y., 27 Aug. 1902. He was graduated at Hudson College, Ohio, in 1844; studied law at Harvard, was admitted to the bar in 1847 and joined a law firm in Cincinnati of which Salmon P. Chase (q.v.) was the leading member. He was appointed judge of the Superior Court of Cincinnati in 1859, and re-elected in 1864. He took a leading part among the "Barnburners" (q.v.), was a War Democrat, and during the war joined the Republican party. He defeated Foraker in a contest for the governorship of Ohio in 1883, but failed of re-election in a struggle against the same candidate.

HOADLEY, Benjamin, English Anglican prelate: b. Westerham, Kent, 14 Nov. 1676; d. Chelsea, 17 April 1761. He was educated at Cambridge; took orders in 1701, and after being settled in London distinguished himself in controversy with Bishop Atterbury and others. A staunch Low-Churchman, he was appointed bishop of Bangor in 1715. During his incumbency he is not known to have visited the diocese. A sermon preached before the king in 1717 gave rise to the "Bangorian Controversy" regarding the divine authority of the king and the Church. He was translated to the see of Hereford in 1721, to Salisbury in 1723 and Winchester in 1734.

HOANG-HO. See HWANG.

HOAR, Ebenezer Rockwood, American jurist: b. Concord, Mass., 21 Feb. 1816; d. there, 31 Jan. 1895. He was the son of Samuel Hoar (q.v.), was graduated at Harvard (1835), and subsequently admitted to the bar. He rose to be judge of the Court of Common Pleas (1849), judge of the State Supreme Court (1859), and Attorney-General of the United States (1869), and was a member of the Joint High Commission that framed the Treaty of Washington (1873–75).

HOAR, George Frisbie, American statesman: b. Concord, Mass., 19 Aug. 1826; d. Worcester, Mass., 30 Sept. 1904. Senator Hoar's paternal and maternal inheritance was very remarkable. His grandfather was an officer in the Revolutionary army and his father, Samuel Hoar, was one of the ablest lawyers and statesmen of his time, a member of Congress from Massachusetts and a man of great learning and force of character. Senator Hoar's mother was a daughter of Roger Sherman, a signer of the Declaration of Independence. He was graduated from Harvard in 1846, studied law there and began his law practice in Worcester, Mass. The young man was early attracted to politics and identified himself with the Free Soil party, and his purpose in 1895 — so characteristic of his whole career — is thus stated by himself: "All of us Free Soilers were drawn into politics by a great issue. It was to prevent slavery being extended into the new territory between the Mississippi and the Pacific. We were all ardent advocates of freedom. The party and the movement were new and we were stirred by high ideals. Among the young men who went into the new movement at that time were my brother, Ebenezer Hoar, Erastus Hopkins, Anson Burlingame, Whittier, Lowell, Longfellow and many others that became well known. There were no offices to gain. There was simply a cause to work for. In the campaign of 1850 the Free Soilers did not carry a single State, only a few Congressional districts." He was a member of the Republican party from the first and in 1852 was elected to the Massachusetts house of representatives; in 1857 to the State senate. In the intervals of service he practised law. In 1860 he was city solicitor. He presided over the Republican conventions in Massachusetts in 1871, 1877, 1882 and 1885; was a delegate to his party's national conventions in 1876, 1880 (the chairman in that year), 1884, 1888, 1892 and 1896. He served in the national House of Representatives for four successive Congresses, 1869–77, elected as a representative of the Worcester district; in 1877 he was elected to the Senate and was re-elected in 1883, 1889, 1895 and 1901, serving his country continuously as a national legislator since 1869, having represented Massachusetts for a longer period in the national Congress than any other representative from that State. In 1876, he was one of the managers on behalf of the House in the Belknap impeachment trial, and was also a member of the Electoral Commission (q.v.), which decided the Hayes-Tilden contest for the Presidency, the other Republican members of that famous body being Senators George T. Edmunds, O. P. Morton and Frederick T. Frelinghuysen, and Representative James A. Garfield. In the Senate he was chairman of the Judiciary Committee, and of the Committee on Privileges and Elections, and a member of other important committees. He was known as the old man eloquent of the Senate, having served in that body for 37 years and taken part in all the great questions that have been before the country during that time. He was a determined opponent of the retention of the Philippines and independent enough to state his views fearlessly in the support of his own theory that the United States should leave the islands to the control of the Filipinos and prevent interference from foreign nations, but his honesty and sincerity were unquestioned and he always retained the confidence of his party and the respect of all. He was a thorough American and believed in the future of his country and placed its welfare above all personal considerations. "The lesson which I have learned in life, which has been impressed upon me daily and more deeply as I grow old," he said in his autobiography, "is the lesson of Good Will and Good Hope. I believe that to-day is better than yesterday, and that to-morrow will be better than to-day. I believe that, in spite of many errors and wrongs, and even crimes, my countrymen of all classes desire what is good, and not what is evil."

Senator Hoar was an idealist, and was not to be turned aside, even by his loyal love of party, from following his sincere convictions. He demanded justice for the negroes and the Indians, openly declared his sympathy for Cuban and Filipino, and as firmly opposed religious intolerance in Massachusetts because his actions were controlled by reasons which he considered were founded in righteousness and truth, and therefore not subject to change.

Senator Hoar was a man of considerable scholarship and took great delight in literary and historical studies. He was a member of several historical and scientific societies, and took much interest in their work. He was president of the American Historical Society, president of the American Antiquarian Society, regent of the Smithsonian Institution in 1880, and trustee of the Peabody Museum of Archæology. He received the degree of LL.D. from the College of William and Mary, Amherst, Yale and Harvard. In 1903 he published 'Autobiography of Seventy Years,' which first appeared in *Scribner's Magazine* as a serial. The same year, in a speech in his home city of Worcester, Senator Hoar, as if in anticipation of his approaching dissolution, thus summed up the creed of his career:

«If my life has been worth anything, it has been because I have insisted, to the best of my ability, that these three things — love of God, love of country, and manhood — are the essential and fundamental things, and that race, color, and creed are unessential and accidental.»

Although 78 years of age, he was in good health until the death of his beloved wife in 1903; their devotion had led many to predict that neither would long survive the other. Senator Hoar was taken seriously ill in June 1904, but lingered until 30 September, when he died at Worcester, Mass.

His death was the occasion of a remarkable display of panegyric in the press of both Republican and Democratic parties. It possessed the peculiar quality of reconciliation, one party regretting what the other considered his noblest quality. The only flaws in his judgment, said the Republican press, were his disagreements with the party leaders on the Philippine and Panama issues; but to the Democratic press his noble loyalty to the right on these occasions was convincing proof of his lofty statesmanship. The Democratic press regretted his inability to see any good in their party, while to Republican journals this virtue redeemed his errors of judgment on the matters of party policy.

One journal said: «As long as the confidence and affection of all the people are given to such a man, it is foolish and false to assume that the old standards are departing and the old ideals becoming broken. The people still know a man when they see him. Still they respect and honor the statesman who loves the republic better than he does himself, who never falters in his service, to whose fingers gold does not cling, and whose never-forgotten ideal is the people's welfare. While they honor such qualities above all others, pure and able statesmen will continue to come to their service,» sentiments which were summarized in Ex-President Cleveland's statement that «Senator Hoar's ability, his high-mindedness, and his freedom from political trickery, furnish an example of a useful life which may well be imitated by all those entrusted by their countrymen with public duties.»

HOAR, Samuel, American lawyer and legislator: b. Lincoln, Mass., 1778; d. 1856. He was graduated at Harvard in 1802 and three years later entered upon a highly successful career as a lawyer. He served two terms as a State senator and was chosen by the Massachusetts legislature to challenge the constitutionality of certain laws in South Carolina relating to the imprisonment of free negroes. He was subsequently excluded from South Carolina courts by the State legislature.

HOARHOUND. See Horehound.

HOBART, Garret Augustus, American lawyer and politician: b. Long Branch, N. J., 1844; d. Paterson, N. J., 2 Nov. 1899. He was graduated at Rutgers College, New Jersey, in 1863, and admitted to the bar in 1866. At Paterson, where he made his home till his death, he enjoyed a successful law practice. He became successively city attorney, prosecuting attorney for Passaic County, a member of the State assembly 1873–78, and of the State senate 1879–85. During his several terms he was speaker of the assembly and president of the senate. In 1896 he was nominated at Saint Louis for Vice-President on the ticket with William McKinley, whose intimate friend he was, and was elected to that office. Here he was more than the proverbial figurehead, exercising a strong influence at the capital in favor of sound business methods. In his later years he was known also as a banker and capitalist.

HOBART, George Vere, American journalist, playwright and author: b. Cape Breton, N. S., 16 Jan. 1867. He was educated in Nova Scotia, later coming to the United States as a telegraph operator for the United Press. He became editor of the Cumberland *Sunday Scimitar,* later writing for the *Herald, Evening News* and *American* of Baltimore. Since then he has been writing for the Hearst newspapers the humorous sketches, 'John Henry' and 'Dinkelspiel.' He has written 'Many Moods and Many Meters' (1890), and 'Li'l Verses for Li'l Fellers' (1903), both poems; the 'Dinkelspiel' series the 'John Henry' books (1901–04), and the plays, 'After Office Hours,' 'Miss Print,' 'Hodge, Podge & Co.,' 'Sally in Our Alley,' etc.

HOBART, John Henry, American Protestant Episcopal bishop: b. Philadelphia, 14 Sept. 1775; d. Auburn, N. Y., 10 Sept. 1830. He was educated at the College of Philadelphia (now the University of Pennsylvania) and the College of New Jersey (now Princeton), and after trying commercial life in his brother-in-law's counting-house, went back to Princeton as a tutor for two years, and was ordained deacon in 1798 and priest in 1801. After brief periods of pastoral service in Pennsylvania, New Jersey and Long Island, he became assistant in Trinity Parish, New York, where he remained until his elevation to the episcopate, combining with his other duties a prominent share in the legislative councils of the Church, as deputy to the General Conventions of 1801 and 1804, and secretary to the House of Deputies in the latter year. In 1811 he was consecrated as bishop-coadjutor in the diocese of New York, and upon the death of Bishop Moore in 1816 succeeded him both in the full charge of the diocese and in the rectorship of Trinity Church. He also gave provisional episcopal care at different times to New Jersey and Connecticut. He was very active in promoting the establishment of the General Theological Seminary, and upon its location in New York became professor of pastoral theology. Hobart College also owed much to him, a debt recognized by the taking of his name, when, in 1852, the original title of Geneva College was changed to Hobart Free College. He wrote or edited a number of theological works, some of which, especially his 'Companion for the Festivals and Fasts' (1805), reached several editions. His 'Apology for Apostolic Order' (1802) is still used as a textbook.

HOBART, the capital of Tasmania, and up to 1881 called Hobart Town, is situated at the foot of Mount Wellington (4,166 feet high), on the Derwent River, 12 miles from its outlet in Storm Bay on the south coast. It has handsome public buildings, including government house, the government offices, Parliament houses, Episcopal and Catholic cathedrals, technical schools, hospitals, library, museum and art gallery. There are important domestic manufactures, and in connection with its considerable shipping interests, a fine harbor with modern accommodations for ships of the largest size. Hobart is connected by rail with Launceston, and has steam communication with Sydney, Melbourne, New Zealand and England. It has several fine parks and drives and is a favorite summer resort. Hobart was settled in 1804 and became a city in 1857. A United States consul resides here. The temperature varies from 42° in winter to 63.1° in summer. Pop. 27,526; with suburbs 39,937.

HOBART COLLEGE, located at Geneva, N. Y. In 1825 it was chartered as Geneva College, but in 1852 the name was changed to Hobart Free College, and in 1860 to Hobart College. Bishop Hobart (q.v.) had aided the school by advice and by money. An endowment from Trinity Church, New York, had greatly assisted the institution. The college offers scholarships and prizes to worthy students, and the departments are all well sustained. The courses lead to the degrees of A.B. and B.S. There are about 60,000 volumes in the library. In 1915 the school had 24 professors and instructors and 135 students. The graduates number about 1,700. In 1906 the college received a bequest of a half million dollars from Mr. William Smith of Geneva for the establishment of a co-ordinate college for women. This college, known as William Smith College, was opened in 1908. The faculty of Hobart College with the addition of four women constitutes the faculty of William Smith College. All instruction is, however, given separately in the two institutions. The number of students in William Smith College in 1916 was 107.

HOBART PASHA, Augustus Charles Hobart-Hampden, third son of the Earl of Buckinghamshire, English sailor: b. Walthamon-the-Wolds, Leicestershire, 1 April 1822; d. Milan, Italy, 19 June 1886. He entered the English navy as midshipman 1836 and retired as captain at the conclusion of the Crimean War in 1856. During the American Civil War he took the name of «Captain Roberts» and was given command of a blockade runner, an account of which is to be found in his ‹Sketches of My Life› published posthumously. In 1867 he entered the sultan's service, reorganized the Turkish navy, and fought the Russians on the Black Sea in the War of 1877–78. He was made pasha (1869) and marshal of the Turkish Empire (1881).

HOBBEMA, Meindert, mīn'dĕrt hŏb'ē-mä, Dutch landscape painter: b. Amsterdam, 1638; d. there, 7 Dec. 1709. He was considered, next to J. Ruysdaal, the best of the Dutch landscape-painters, and as a colorist reckoned even superior to Ruysdaal. The figures in his landscapes are painted mostly by Berchem, Van de Velde, Lingelbach and J. Van Loo. His paintings consist chiefly of forest scenes, ruins, villages, etc. Some of the most celebrated works of this master are to be found in public or private galleries in France, Germany and Holland. His greatest painting is ‹A View in Holland,› with figures painted by Adrien van de Velde.

HOBBES, John Oliver. See Craigie, Pearl Mary Teresa.

HOBBES, Thomas, English moralist, philosopher and political scientist: b. within the borough of Malmsbury, Wiltshire, 5 April 1588; d. Hardwicke, Derbyshire, 4 Dec. 1679. Thomas Hobbes is eminent as writer on the theory of government, on psychology and on metaphysics and as master of a vigorous and picturesque English style. He was born in the year of the Spanish Armada, 1588, and lived to be 91 years old, active to the end in mind and in body. He was the son of a poor English vicar, was educated by his uncle, a prosperous glover, and spent the last five of his student years at Magdalen College, Oxford. The Oxford of that period was given over to a restricted and arid scholasticism, barring out mathematics, for example, as a black art; and Hobbes retained through life a vivid memory of the pedantry and narrowness of the Oxford of his youth. At the end of these student years, in 1608, he was employed by Cavendish, afterward Earl of Devonshire, as tutor to his son; and he remained for the next 20 years in the service of this same great family and throughout his life in close and friendly connection with it. Two years of travel with his pupil on the Continent were followed by 18 years in England — a service terminated only by the death of his former pupil and constant friend, the second Earl. During these years Hobbes devoted himself to classical study, which bore fruit in his vigorous translation of Thucydides, published in 1628. The three succeeding years were spent on the Continent, at first in travel with another English youth, later in the eager study, mainly at Paris, of mathematics and natural science. Hobbes himself tells us with what astonishment and delight he first, in 1628, when he was 40 years old, saw and read Euclid's ‹Elements.› In 1631 he became tutor to the third Earl of Devonshire, son of his late patron and first pupil. With him he made, in 1634, a third continental journey, learned to know Galileo during his sojourn in Italy, and was admitted, in Paris, to the fellowship of a group of mathematicians and scientists. He must have been pondering on problems of politics and of psychology in the intervals of his study of physics and geometry, for his next book, which circulated in manuscript as early as 1640, set forth his theory of human nature and of the body politic. The publication even privately of this doctrine brought its author into prominence and strongly influenced the course of his life.

The psychology of Hobbes forms the basis both of his political and of his metaphysical doctrine. He distinguishes the «cognitive (or conceptive)» faculty from the «motive» faculty of the mind, and recognizes five senses, to which he adds «a sixth sense, but internal, . . . commonly called remembrance.» He defines the affective consciousness as «motion about the heart,» which «when it helpeth is called pleasure

. . . but when it hindereth the vital motion is called pain.» And he ends with a discussion of the passions which reduces will to desire and conceives each emotion from a narrowly individualistic standpoint. «To endeavour,» he says, «is appetite» and, in the race of life, «continually to out-go the next before is felicity.»

The foundation of the political system of Hobbes is the teaching that men «are by nature equal» and self-seeking; that «many men at the same time have an appetite to the same thing; which yet very often they can neither enjoy in common, nor yet divide»; that consequently «every man is enemy to every other» and that «during the time men live without a common power to keep them all in awe, they seek such a Common Power, as may be able to defend them from invasion of foreigners and are in that condition which is called War.» «The only way,» Hobbes continues, «to erect such a Common Power, as may be able to defend them from invasion of Foreigners and the injuries of one another . . . is to confer all their power and strength upon one man or upon one Assembly of men, that may reduce all their Wills, by plurality of voices, unto one Will.» Hobbes accordingly conceives of a government as formed by a mutual contract of individuals, of whom each seeks simply his own preservation, happiness and security. The contract, he insists, is between each individual «subject» and every other — not at all, between subject and sovereign. It is made, he says, «by covenant of every man with every man . . . as if every man should say, *I authorise* and give up my Right of Governing myself to this Man, or to this Assembly of men, on this condition, that thou give up thy Right to him.» Upon this theory, that the covenant of every citizen with every other underlies government, Hobbes bases his well-known doctrine of the absolute right of the sovereign. For, he argues, all the governed «are bound, every man to every man to Own and be reputed Author of all, that he that already is their Sovereign, shall do, and judge fit to be done.» In other words «every Subject is Author of every Act the Sovereign doth.»

Hobbes asserts unambiguously the subordination of church to state. «The Kingdom of Christ,» he declares, «is not of this world; therefore neither can his ministers (unless they be Kings) require obedience in His name.» It follows, he teaches, «that every Christian Sovereign [is] the supreme Pastor of his own Subjects»; and that every subject is bound to obey the command of his sovereign with regard not only to the forms of religious worship but to the nature of the doctrines openly professed. Such conformity to the will of even an «infidel sovereign» does not conflict, Hobbes insists, with our duty to God. For God requires of us only faith and obedience to his laws. «And when the Civil Sovereign is an Infidel, every one of his own Subjects that resisteth him sinneth against the Laws of God (for such are the Laws of Nature) and rejecteth the counsel of the Apostles that admonisheth all Christians to obey their Princes. . . . And for their *Faith* it is internal and invisible; they have the license that *Naaman* had, and need not put themselves into danger for it. But if they do, they ought to expect their reward in Heaven, and not complain of their Lawful Sovereign; much less make war upon him.»

It is not possible, within the limits of this article, to outline the ingenious argument by which Hobbes seeks to foist upon a present generation, the responsibilities of a social contract which a past generation made. Still less is it possible to present an adequate criticism of the conception of Hobbes. Psychologists and sociologists have long since agreed that his psychology and his political theory are alike defective; that societies and governments grow, and are not manufactured; and that sympathy no less than selfishness is a basal instinct. Yet Hobbes' theory of society is still worth studying, not only because it is expressed in such vigorous English, nor even mainly because of the influence it exerted on Rousseau and Spinoza (qq.v.), but primarily because it so ruthlessly depicts society as it would be if men were no more than self-seeking and egoistic.

It is evident that the brilliant attempt of Hobbes to justify the absolute supremacy of the monarch could find little favor in England in the years of the Parliamentary struggle with Charles I. Hobbes, who was morbidly timid, believed that he stood in personal danger and betook himself, a voluntary exile, to Paris where he spent 11 years in the society, on the one hand, of French men of science and letters, and on the other hand, of the English royalists. In 1646 Hobbes became the tutor of the young prince, later Charles II. He published in the meantime an epitome in Latin, ‹De Cive,› of his doctrine of government, and afterward the earlier work already referred to. In 1651 he brought out the work by which he is best known, ‹Leviathan, Or, The Matter, Form and Power, of a Commonwealth.› This book is the most popular, forcible and detailed discussion of the political theory of Hobbes. It is prefixed by several chapters which are properly psychological, and which embody an egoistic and sensationalistic psychology full of acute introspection and of keen discrimination. The later chapters of ‹Leviathan› include suggestions of materialistic doctrine. In spite of its monarchical tendency, ‹Leviathan› was violently opposed by the influential clerical party among the English royalists in Paris. Hobbes concluded that he would be safer even in Puritan England, returned accordingly and lived unmolested under the Cromwells. At the Restoration, in 1660, he regained the royal favor and he never afterward lost the protection of his old pupil, Charles II.

The metaphysical doctrine of Hobbes is expounded in two books published a few years after his return to England, ‹De Corpore,› which appeared in 1655, and a translation, ‹Concerning Body,› published a year later. This teaching is succinctly stated in these words: «The world (I mean . . . the whole mass of things that are), is corporeal, that is body; . . . and that which is not body is no part of the universe.» The doctrine of Hobbes is, in other words, frankly materialistic: he teaches that the innumerable realities which go to make up the universe are, one and all, nonspiritual, or material. So-called spirits are, he holds, merely subtle and intangible bodies; and even God, the First Cause of the universe is body. The philosophy of Hobbes becomes in its detail a system of mechanics or of physics; for, since all reality is physical, laws of space or of motion must be ultimate laws.

The metaphysical doctrine of Hobbes deserves more attention than it often receives, because it is so thoroughgoing and internally consistent a system of materialism. The arguments, implicit rather than explicit, on which Hobbes bases it are none the less, in the view of the writer of this notice, unsound. In brief, Hobbes argues for materialism partly because of the untrustworthiness of consciousness, and partly on the ground that physical motions are admitted to be cause of consciousness. «It is evident,» he says, while describing the phenomenon of vision, in the second chapter of ‘Human Nature,’ «that from all lucid . . . bodies, there is a motion produced to the eye, and through the eye to the optic nerve and so into the brain . . . and thus all vision hath its original from . . . motion.» From similar observations he concludes that ideas (or in his own words, apparitions or phantasms) «are nothing really but motion . . . .» The reasoning that consciousness because *conditioned by* motion is, therefore, *identical with* motion is evidently illicit; and it is observable that Hobbes, when he tries to define body, motion and space, really conceives them in terms of ideal reality.

Just before the appearance of the metaphysical works, in 1654, an essay ‘Of Liberty and Necessity,’ written by Hobbes eight years before in the course of a private discussion with Bishop Bramhall, was published without the knowledge and consent of the author. It was followed in 1656 by a longer and more polemical work, ‘The Questions Concerning Liberty, Necessity and Chance, clearly Stated and Debated between Dr. Bramhall . . . and Thomas Hobbes.’ The unambiguous teaching of these works is a determinism grounded in psychology, the doctrine «that voluntary actions have all of them necessary causes and are therefore necessitated.»

Most of the works which Hobbes published from this time onward are, indeed, controversial in character. Most bitter of them are the books and essays on mathematical subjects, maintaining against Wallis and Ward, Savilian professors in Oxford, the possibility of squaring the circle. The titles of two of these works are an indication of the spirit in which Hobbes wrote them: ‘Six Lessons to the Professors of the Mathematics . . . in the chairs set up by . . . Sir Henry Savile in the University of Oxford’; and ‘Στιγμαι or Marks of the Absurd Geometry, Rural Language, Scottish Church Politics and Barbarisms of John Wallis.’ Hobbes. who was, after all, no trained mathematician, was always worsted in these mathematical contests, but never acknowledged himself defeated.

More serious than the justified criticisms of Ward and Wallis on the mathematics of Hobbes were the attacks upon the orthodoxy and the morality of his teaching. These attacks, and especially the abortive attempt to suppress ‘Leviathan’ by act of Parliament, caused Hobbes great uneasiness. In the Appendix which he added to his translation of ‘Leviathan’ into Latin (published 1668) he argued that the teaching of ‘Leviathan’ is not heretical, and that there remains no English court of heresy; and he wrote at the same time a very vigorous ‘Answer to a Book Published by Dr. Bramhall . . . called ‘Catching of the Leviathan,’ a book in which the bishop of Derry had maintained «that the Hobbian principles are destructive to Christianity and to all religion.» Nobody doubts to-day that these charges are unfounded. Hobbes, it is true, inculcated a materialistic philosophy and an egoistic and necessitarian ethics; but upon these doctrines he himself based both the philosophical conclusion that God exists, and an ethical system which exhorts to justice and social virtues, even while it derives these virtues from purely selfish instincts. It is necessary to suppose that many of the men who decried Hobbes had never read him; and that the epithets «free-liver» and «atheist,» which writers of his own and the following century heaped upon him were due, in part at least, to the fact that Hobbes remained throughout his life in some sense under the protection of his former pupil, Charles II. Very unjustly, therefore, he was held responsible for the lax morals of the court. It should be added that from this time onward Hobbes failed to gain from the censor license to publish any work on a political or on an ethical subject. The chief of the works, written at this period but published after the death of Hobbes, is ‘Behemoth: The History of the Causes of the Civil Wars of England . . . from the Year 1640 to the Year 1660.’

Hobbes spent the last four years of his life with the family he had so long served, that of the Earl of Devonshire. In these later years he returned to the classical studies of his youth, publishing, when he was 87 years old, ‘The Iliads, and Odysseys of Homer, translated out of Greek into English, with a large preface concerning the Virtues of an Heroic Poem.’ In his very last year he wrote a sketch, in Latin metre, of his own life. He had feared many things, and death most of all, but he died quietly after a short illness, in 1679. See LEVIATHAN.

Bibliography.— The authoritative edition of Hobbes is that of Sir William Molesworth: ‘English Works’ (in 11 vols.); ‘Opera Latina’ (in 5 vols., London 1839–45). A recent reprint of the ‘Leviathan’ is that of Thornton (Oxford 1881). Selections, mainly from the ethical and political writings, are those of E. H. Sneath (1898), and F. J. E. Woodbridge (1903). ‘The Metaphysical System of Hobbes,’ edited by M. W. Calkins (Chicago 1905), contains the important chapters of ‘Concerning Body.’ For biography and criticism the reader is referred to G. C. Robertson, ‘Hobbes’ (1886); Leslie Stephen, ‘Hobbes’ (1884); and Tönnies, ‘Hobbes, Leben und Lehre’ (1896). For complete list of the writings of Hobbes and for further references to his critics, one should consult the works just cited and the Bibliography of Benjamin Rand, published as Vol. III, Pt. I of Baldwin's ‘Dictionary of Philosophy and Psychology.’

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HOBBLE-BUSH, a viburnum (*V. alnifolium*) of the southern interior of the United States, whose branches often stretch along the ground and root at the other end tripping up the unwary; hence it has such other names as warfaring-tree, tanglefoot and devil's-shoestrings. The branches are long, flexuous and reddish in color, and the leaves are nearly orbicular and turn to a deep red in the autumn. See VIBURNUM.

HOBKIRK'S HILL, Battle of, in the Revolution, 25 April 1781. After Guilford Court-house (q.v.), Greene marched toward the British position at Camden under Rawdon and encamped at Hobkirk's Hill, about one and one-half miles north. He had 940 men in line, prudently encamping in order of battle; and some militia just arrived who took no part in the battle. His trains and artillery had not come up, and a renegade drummer boy informing Rawdon of this, the latter took action and making a detour to the right through the woods in front of Greene, drove in Greene's pickets with so sudden an onslaught that the Americans had barely time to form. Greene ordered the First Maryland to charge bayonets and William Washington to take the British in the rear with his cavalry, while Ford and Campbell executed flanking movements on Rawdon's wings. But Ford was killed, one of the First Maryland's captains was shot, the men fell into disorder, and Colonel Gunby ordered the regiment to form on the rear companies instead of moving the latter forward; the retiring men were seized with a panic, the famous veterans broke, and though soon reformed, the position was dangerous and Greene had to retreat. Gunby was court-martialed, but acquitted of anything but grave misjudgment. Greene's loss was 135, besides missing militia; Rawdon's 220 (his own figure) or 258 (Tarleton's). Consult Dawson, 'Battles of the United States' (New York 1858); Carrington, 'Battles of the American Revolution' (New York 1877).

HOBOKEN, hō'bō-kĕn, N. J., city in Hudson County, on the Hudson River. It is the terminus of the Delaware, Lackawanna and Western, the Lehigh Valley and the West Shore railroads. It is opposite New York city, north of and adjoining Jersey City, and has on the north and west the Palisades. Its area is about one square mile. It has electric railway connections with a number of the cities and towns of the State, and by direct ferries and tunnels with the business district of New York. The principal streets run north and south, nearly parallel with the river. Its long water-front gives it excellent shipping facilities; and here are located the docks of the ocean steamship lines, the Thingvalla, the Netherlands-American, the Scandinavian-American and the former German-American lines. The land upon which Hoboken is located, as well as much of that adjoining, once formed a part of the territory of New Netherlands. It was early known as Hobocan Hacking, which means "the land of the tobacco-pipe." The tobacco-pipes which were made by the Indians from the stone found in the vicinity gave rise to the name. In 1630 Michael Pauw of Holland purchased from the New Netherlands Company a tract of land a part of which is the site of the present city of Hoboken. The land around was soon cultivated and as New Amsterdam grew in numbers and importance, the gardens across the river became more valuable. John Stevens (q.v.), in 1804, purchased the land upon which the city now stands, and began the town. The development of steam navigation and steam railroads received an early impetus in Hoboken. John Stevens invented and first employed here the modern type of ferry slip, made of piling. He also invented and put into operation at Hoboken the first steam-propelled ferryboat in 1811. At this time and for some years after the Elysian Fields of Hoboken were much used as pleasure grounds by New Yorkers. At first Hoboken was a part of the town of North Bergen, but on 28 March 1855 it was incorporated as a city. The disastrous fire at the wharves of the North German Lloyd Steamship Company, which occurred in 1900, destroyed considerable of the city property and three steamers. The estimated number of lives lost was 200. The chief manufactures of Hoboken are iron products, machine engines, technical instruments, motor fire engines, castings, elevators, inks, metal tubes, waterproof fabrics, leather, silk, lead-pencils, caskets, wall-paper, beer, ship-building and repairing and chemicals. It has extensive coal yards and large lumber and brick yards. The drainage of the lowlands is under way and by this means a large tract of land will be reclaimed and the sanitary conditions of the city improved. The city is the seat of the Stevens Institute of Technology (q.v.), and of the Sacred Heart Academy. It has Saint Mary's hospital, public and parish schools and several fine church buildings. The municipal income amounts to about $4,000,000 annually, and the expenditures almost reach the same figure. The government is vested in a mayor, who holds office two years, and a city council. The mayor appoints the school, library, fire and health commissioners, also the assessors. The police commissioners are appointed by the mayor and approved by the council. The council elects the inspectors, the city clerk and his assistants. Pop. 74,994.

HOBSON, John Atkinson, English social economist: b. Derby, England, 6 July 1858. He was graduated at Oxford University, and from 1887 to 1897 taught English literature and economics for the University Extension Delegacy, and the London Society for the Extension of University Teaching. He is one of the foremost of economic writers in England and, as a Socialist, advocates the monopolistic control of industries by government, whether municipal or national. Among his works are 'The Physiology of Industry: Being an Exposure of Certain Fallacies in Existing Theories of Economics' (with A. F. Mummery, 1889); 'The Evolution of Modern Capitalism' (1894); 'The Social Problem' (1901); 'Imperialism' (1902); 'Canada To-day' (1906); 'The Industrial System' (1909); 'The Science of Wealth' (1911); 'Gold, Prices and Wages' (1913); 'Work and Wealth' (1914); 'Towards International Government' (1915); 'The New Protectionism' (1916); 'Democracy after the War' (1917).

HOBSON, Richmond Pearson, American naval constructor, lecturer and author: b. Greensboro, Ala., 17 Aug. 1870. He was graduated at the Annapolis Naval Academy in 1889 and took a post-graduate course at the Ecole Nationale Supérieure des Mines, and the Ecole d'Application du Génie Maritime in Paris. As midshipman he accompanied the White Squadron in Mediterranean and south Atlantic waters in 1889–90, in 1894–95 was on duty at the Navy

Department, in 1895–96 was stationed at the New York navy yard and in the following year was in charge of construction at Newport News. In 1897–98 he organized and conducted the post-graduate course for officers destined for the construction corps at the United States Naval Academy. Early in 1898 he served as constructor with the fleet, his principal work dealing with stability and fire systems of vessels in action. During the war with Spain he was present in the bombardment of Matanzas and took part in the expedition against San Juan, Porto Rico. He distinguished himself by his heroism in sinking the collier *Merrimac* across the entrance to Santiago Harbor, on the night of 3 June 1898, for the purpose of preventing the exit of Cervera's fleet. While he did not succeed in blocking the entrance to the harbor because the *Merrimac* was disabled by gunfire before reaching the point chosen, and when sunk lay almost parallel with the channel, the exploit brought commendation even from the enemy and Hobson and his comrades became the heroes of the nation. From 3 June to 6 July 1898 he was confined as a prisoner of war in a Spanish fortress, but was well treated. Subsequently he was inspector of Spanish wrecks and had charge of the salvage operations of the Spanish warships beached along the south shore of Cuba in the battle of 3 July 1898. In 1899–1900 Hobson was on duty in the Far East and from 1900 to 1903 had charge of naval construction at several stations. In the latter year he resigned from the navy. In 1904 he was presidential elector-at-large from Alabama. From 1907 to 1915 he was member of Congress from the sixth Alabama district. Mr. Hobson is prominent as lecturer, speaker and writer and as an advocate of American naval supremacy and of American leadership in the international movement for peace. He is also an advocate of nation-wide and world-wide prohibition and was the first to introduce in Congress a prohibition amendment to the Constitution. He is the author of ‹A Study of the Situation and Outlook in Europe› (1894); ‹The Disappearing Gun Afloat›; ‹The Sinking of the Merrimac› (1900); ‹America Must be Mistress of the Seas› (1902); ‹Why America Should Hold Naval Supremacy› (1903); ‹Buck Jones at Annapolis› (1907); ‹Diplomacy and the Fleet› (1908); ‹Arbitration and Armaments› (1908); ‹In Line of Duty› (1909); ‹America's War Policy› (1910); ‹Fortification of the Panama Canal› (1911); ‹The Great Destroyer: Alcohol› (1911); ‹Our Country's Destiny› (1913); ‹Destroying the Great Destroyer› (1915); ‹America and the World War› (1917); ‹The Great Reform› (1918).

«HOBSON'S CHOICE,» may best be translated, «that or nothing.» Tobias Hobson was a carrier and innkeeper at Cambridge, who erected the handsome conduit there and settled «seven lays» of pasture ground toward its maintenance. But the story about him, as told by *The Spectator*, is as follows: «He kept a stable of forty good cattle, always ready and fit for traveling; but when a man came for a horse he was led into the stable, where there was great choice, but was obliged to take the horse that stood nearest to the stable door, so that every customer was alike well served, according to his chance, and every horse ridden with the same justice.» Milton wrote two quibbling epitaphs upon this eccentric character.

HOCCLEVE, Thomas, English poet of the 15th century. See OCCLEVE, THOMAS.

HOCHE, Lazare, lä-zär ōsh, French soldier: b. Montreuil, 25 June 1768; d. Wetzler, 19 Sept. 1797. He took service in the French guards when 16 years old, and at the Revolution joined the popular party. He greatly distinguished himself at the siege of Thionville and the defense of Dunkirk, and shortly afterward, when scarcely 25 years of age, received the command of the army on the Moselle. In 1793 he drove the Austrians out of Alsace, and soon after was arrested by the Jacobins and imprisoned at Paris. In 1794 he was released, and appointed commander of the army destined to quell the rising in the west, and afterward to that in La Vendée. In 1796 he conceived the plan of attacking Britain, and making a descent on Ireland, but expired suddenly while in camp with his army of invasion.

HOCKEY, a game of ball known as hurley in Ireland and shinty in Scotland, dating in its present form from about 1883, when a definite code of rules was drawn up by the Wimbledon Club. According to standard rules the game is played between two teams of 11 players each, on a ground 100 yards long by 50 to 60 yards wide. A goal is erected at each end of the field, and consists of two uprights 12 feet apart supporting a horizontal bar 7 feet from the ground. In front of each goal a line 12 feet long is drawn parallel to the goal-line and 15 yards from it; and from each end of this line, with the corresponding goal-post as centre, a segment of a circle is drawn outwards to meet the goal-line. Thus, a kind of semi-circle flattened at the top is drawn in front of each goal, and no goal is scored unless the ball is hit from within this line or striking-circle. The ball used is an ordinary cricket ball painted white; and each player is provided with a stick, curved at the end, without any metal fittings, and not too thick to be passed through a ring two inches in diameter. The players are arranged on the field as in Association football, namely, goal-keeper, two backs, three half-backs, five forwards. The game is started by one player of each side bullying the ball in the centre of the ground, that is, by first striking the ground with his stick and then striking his opponent's stick three times, after which either may strike the ball. When the ball is driven between the goal-posts under the bar by a stroke from within the striking-circle, a goal is scored, and the game is won by the side with a majority of goals scored. The ball may be caught or stopped with any part of the body, but it must not be carried, kicked or knocked on except with the stick; it must be played from right to left only. The goal-keeper is allowed to kick the ball away in defending his goal. Ends are changed at half-time.

HOCKING, Joseph, English Non-Conformist clergyman and novelist: b. Saint Stephen's, Cornwall, 1859. He was educated at Owens College, Manchester, and entered the Non-Conformist ministry in 1884. Among his many published books are ‹Story of Andrew Fairfax› (1893); ‹The Scarlet Woman› (1899); ‹The Purple Robe› (1900); ‹The Madness of David

Baring’ (1900); ‘Lest We Forget’; ‘O’er Moor and Fen’ (1901); ‘Greater Love’ (1903); ‘Esau’ (1904); ‘The Woman of Babylon’ (1906); ‘The Trampled Cross’ (1907); ‘The Jesuit’ (1911); ‘Spirit of the West’ (1913); ‘All for a Scrap of Paper’ (1914); ‘The Day of Judgment’ (1915); The Path of Glory, Tommy and the Maid of Athens’ (1917). He is a brother of S. K. Hocking (q.v.).

HOCKING, Silas Kitto, English Methodist clergyman and novelist: b. Saint Stephen’s, Cornwall, 24 March 1850. He was ordained a minister in the Methodist Free Church in 1870, and after holding pastorates in Liverpool, Manchester and elsewhere, resigned from the ministry in 1896. He is a prolific writer and several of his books have been much read in America. Among them may be named ‘Alec Green’ (1878); ‘For Light and Liberty’ (1890); ‘One in Charity’ (1893); ‘A Son of Reuben’ (1894); ‘God’s Outcast’ (1898); ‘The Awakening of Anthony Weir’ (1901); ‘Gripped’ (1902); ‘A Bonnie Saxon’ (1903); ‘Smoking Flax’ (1904); ‘The Flaming Sword’ (1906); ‘A Modern Pharisee’ (1907); ‘Yours and Mine’ (1909); ‘Who Shall Judge’ (1910); ‘The Third Man’ (1911); ‘In Self-Defense’ (1914); ‘His Own Accuser’ (1917)

HOCKING RIVER, a stream which has its rise in Fairfield County, Ohio, and flows southeast into the Ohio River. The whole length is about 80 miles; it is navigable for about 70 miles. Along the shore, in the upper part of the course, is the Hocking Canal.

HODGE, Archibald Alexander, American Presbyterian divine: b. Princeton, N. J., 18 July 1823; d. Princeton, 11 Nov. 1886. He was the son of Charles Hodge (q.v.) and was graduated at Princeton College 1841, where he became assistant professor. In 1847 after graduation in the theological seminary of the same place he went to Allahabad, India, as a missionary. He stayed in Asia for three years and returning home held pastoral charges in Maryland, Virginia and Pennsylvania until 1877, when he became his father’s assistant at Princeton Seminary, succeeding in 1878 to the chair of didactic and exegetical theology made vacant by his father’s death. He was a trustee of Princeton College and for a time was editor of the Presbyterian *Review.* Among his works the most important are ‘Outlines of Theology’ (1879); ‘The Atonement’ (1886); ‘Life of Charles Hodge’ (1880); ‘Manual of Forms, Conformed to the Doctrine and Discipline of the Presbyterian Church’ (1883); ‘Popular Lectures on Theological Themes’ (1887).

HODGE, Charles, American Presbyterian theologian: b. Philadelphia, 28 Dec. 1797; d. Princeton, N. J., 19 June 1878. He was educated in Princeton College, graduating in 1815. In 1816–19 he studied in the theological seminary at Princeton, in 1820 was appointed instructor there and two years later made professor of Oriental and biblical literature. In 1840 he was transferred to the chair of didactic and exegetical theology in the seminary, and 12 years afterward appointed to the additional chair of polemical theology. In 1825 he founded the *Biblical Repertory,* afterward was renamed *Biblical Repertory and Princeton Review* and merged in 1872 in the *Presbyterian Quarterly and American Theological Review.* The semi-centennial anniversary of his connection with Princeton was commemorated there in 1872 by the foundation of the Charles Hodge professorship. with an endowment of $50,000. At the same time he received a gift of $15,000. He was moderator of the Presbyterian General Assembly in 1846 and was one of the revisers of the ‘Book of Discipline’ in 1858. From the foundation till 1872 he was editor of and chief contributor to the *Review,* and two of his works, ‘Princeton Theological Essays’ (1846–47); and ‘Essays and Reviews’ (1857), were compiled from his numerous articles in that periodical. Other works are ‘Commentary on the Epistle to the Romans’ (1855; enlarged 1866); ‘Constitutional History of the Presbyterian Church in the United States’ (1840–41); ‘The Way of Life’ (1842); ‘Systematic Theology’ (1871–72), a comprehensive treatise giving an exposition of Calvinistic theology; and ‘What is Darwinism?’ (1874). Consult ‘The Semi-Centennial Commemoration of the Professorship of Charles Hodge, D.D., LL.D., September 24, 1872’ (Philadelphia 1872), and Hodge, A. A., ‘Life of Charles Hodge, Professor in the Theological Seminary, Princeton’ (New York 1880).

HODGE, Frederick Webb, American ethnologist: b. Plymouth, England, 28 Oct. 1864. He was brought to this country at the age of seven years, and was educated at Washington, D. C. In 1884 he received appointment to the United States Geological Survey, in 1886 became secretary of the Southern Archæological Expedition and in 1889 was appointed to the Bureau of Ethnology, Smithsonian Institution. He explored New Mexico and Arizona in 1895, 1897 and 1899; in 1897 scaled the precipitous «Enchanted Mesa» of New Mexico and found traces of former human occupancy. Since 1910 he has been ethnologist in charge of the Bureau of Ethnology, and prepared the ‘Handbook of American Indians,’ issued by it. He has published ‘List of Publications of the Bureau of Ethnology’ (1894); ‘The First Discovered City of Cibola’ (1895); ‘Coronado’s Route from Culiacan to Quivira’ (1899), and contributions on ethnological topics to scientific periodicals and to standard cyclopedias. He is editor of ‘Narratives of Cabeza de Vaca and Coronado’ (1907); Curtis’s ‘North American Indian.’ He edited the *American Anthropologist* in 1899–1910, and again after 1912. He has written various papers on the Indians of the Southwest.

HODGES, George, American Episcopal clergyman: b. Rome, N. Y., 6 Oct. 1856. He was graduated from Hamilton College, Clinton, N. Y., in 1877, and from the Berkeley Divinity School, Middletown, Conn., in 1881. He was assistant rector of Calvary Church, Pittsburgh, Pa., 1881–89, and rector 1889–94, in the year last named becoming dean of the Episcopal Theological School in Cambridge, Mass. He has published among other works ‘Christianity Between Sundays’ (1892); ‘The Heresy of Cain’ (1894); ‘In the Present World’ (1896); ‘Faith and Social Service’ (1896); ‘The Battles of Peace’ (1897); ‘The Path of Life’ (1897); ‘William Penn’ (1900); ‘When the King Came’ (1904); ‘Holderness’ (1907); ‘The Garden of Eden’ (1909); ‘A Child’s Guide to the Bible’ (1911); ‘Saints and

Heroes’ (2 vols., 1911–12); ‘Training of Children in Religion’ (1912); ‘Castle of Zion’ (1912); ‘Moral Training in the School and Home’ (1913); ‘The Cross and Passion’ (1915); ‘The Episcopal Church, Its Faith and Order’ (1915); ‘Henry Codman Potter’ (1915); ‘Religion in a World at War’ (1917). He is one of the most prominent members of the Low Broad Church School in the Episcopal Church.

HODGKIN, hŏj'kĭn, **Thomas**, English historian and banker; b. Tottenham, Middlesex, 29 July 1831; d. 2 March 1913. He was for many years the senior partner in a banking firm at Newcastle-on-Tyne, but after 1874 gave his time to historical writing, to which he applied scientific methods. He has published ‘Italy and her Invaders’ (1880–99); ‘Dynasty of Theodosius’ (1889); ‘Life of George Fox’ (1896); ‘Life of Charles the Great’ (1897); ‘Political History of England to the Norman Conquest’ (1906); ‘The Trial of Our Faith’ (1911).

HODGKIN’S DISEASE. See PSEUDOLUCÆMIA.

HODGKINSON, hŏj'kĭn-sȯn, **Eaton**, English engineer: b. Anderton, Cheshire, 1789; d. Manchester, 18 June 1861. After a somewhat desultory education he engaged in pursuit of independent investigations in mechanics, which soon brought him fame. His first important work was on strains and the strength of materials, on which subject he read a paper before the Literary and Philosophical Society of Manchester in 1822. He subsequently made researches on the forms of the catenary in suspension bridges and on the strength and best forms of iron beams. He was appointed in 1847 professor of the mechanical principles of engineering at University College, London. He was one of the royal commission appointed in 1847 to inquire into the application of iron in railroad building. He was president of the Literary and Philosophical Society of Manchester in 1848–50. He was a member of the Geological Society, of the Royal Irish Academy, and an honorary member of the Institute of Civil Engineers. He made investigations as to the temperatures of the earth in deep mines. His principal experiments led him to the determination of the «neutral line» in the section of fracture, an important step in the progress of engineering science. Among his many writings is ‘Researches on the Strength and Other Properties of Cast Iron’ (1846). Consult the «Life of Eaton Hodgkinson» in ‘Memoirs of the Manchester Literary and Philosophical Society’ (3d series, No. II, Manchester 1862).

HODGSON, hŏj'sȯn, **Shadworth Hollway**, English metaphysician: b. Boston, Lincolnshire, 25 Dec. 1832; d. 13 June 1912. He was educated at Rugby and Oxford and is the author of ‘Time and Space’ (1865); ‘Principles of Reform in the Suffrage’ (1866); ‘The Theory of Practice’ (1870); ‘The Philosophy of Reflection’ (1878); ‘The Metaphysic of Experience’ (1898), etc.

HOE, Richard Marsh, American inventor: b. New York, 12 Sept. 1812; d. Florence, Italy, 7 June 1886. He was the son of Robert Hoe (q.v.). In 1846 with his brother Peter S. he perfected a rotary printing-press which was called «Hoe’s lightning press.» Subsequently the two brothers invented the Hoe web-perfecting press, which superseded the rotary press and prints upon both sides of the sheet, and includes apparatus for folding and cutting. This was especially adapted to newspaper printing and made a revolution in that art. The sons of Richard M. Hoe and of Peter S. Hoe conducted the business after the death of the brothers, and added various improvements to the original Hoe printing-press. See PRINTING.

HOE, Robert, American inventor: b. Leicestershire, England, 1784; d. 1833. He came to the United States in 1803, was for a time a joiner, and later entered partnership with his brothers-in-law, Matthew and Peter Smith, for the sale of a hand printing-press, the invention of the latter. He took over the business in 1823. He retired in 1832. The original Hoe printing-press was designed and built by him. He is believed to be the earliest American machinist who utilized steam as a motive power in his plant.

HOE, Robert, American manufacturer: b. 1839; d. 1909. He is a nephew of Richard M. Hoe (q.v.). He became the head of the Hoe firm, and maintained its high position among establishments of its class. A founder of the Grolier Club of New York, he was also its first president. He was an extensive collector of rare books and manuscripts as well as of silver, miniatures and other art objects, his collections at the time of his death being valued at several million dollars. He published an edition (1880) of Maberley’s ‘Print Collector,’ and wrote ‘A Short History of the Printing Press’ (New York 1902); ‘Bookbinding as a Fine Art’ (Grolier Club, id. 1886). Consult biographical sketch by Gilliss in ‘New York Genealogical and Biographical Record’ (Vol. XII, ib. 1910).

HOEBER, Arthur, American artist: b. New York, 23 July 1854; d. Nutley, N. J., 29 April 1915. He studied under Beckwith at the Art Students’ League in New York, and under Gérôme at the École des Beaux Arts, exhibited for the first time at the Salon in 1882 and was a contributor to most American exhibitions. He was art critic of the New York *Times* for three years, associate editor of the *Illustrated American* for one year and later became art critic of the New York *Globe and Commerical Advertiser*. He was also known as a lecturer on art. He was elected an associate of the National Academy. Among his writings are ‘Treasures of the Metropolitan Museum of Art’ (1892); and ‘Painting in the 19th Century in France, Belgium, Spain and Italy.’ His Salon picture in 1882 was ‘Sur la Grande Route’ and in 1885 ‘Le Pain Quotidien.’

HÖEGH-GULDBERG, hēg-gụld'bĕrg, **Ove**, Danish statesman: b. Horsens 1731; d. 1808. Appointed preceptor of Crown Prince Frederick, son of Christian VII, he conspired against Queen Caroline and Struensee; and on their overthrow rose rapidly in political power. He became Cabinet Secretary in 1773 and three years later, Secretary of State. From 1784–1802 he was governor of Aarhus. Besides some religious works, he wrote an important ‘Universal History.’

HOFER, hō'fĕr, **Andreas**, Tyrolese patriot: b. Sankt Leonhard, 22 Nov. 1767; d. Mantua, 20 Feb. 1810. He was landlord of the inn "Am Sand" at Sankt Leonhard, and hence often known as "Sandwirt." In 1796 he led a rifle company against the French on Lake Garda, and after the Peace of Lunéville was prominent in the organization of the Tyrol militia. In 1809 he led in an insurrection of the Tyrolese for shaking off the yoke of Bavaria, to which their country had been transferred by the Treaty of Presburg. In a short time, with intermittent assistance from the Austrians, he defeated the French and Bavarian troops, and nearly the whole country was liberated. Hofer then carried on the military and civil administration, till the Peace of Vienna was proclaimed. Misled by false reports he commenced hostilities anew, and thus forfeited the protection of the amnesty. He remained concealed for some time, but was at last betrayed to the French, and carried to Mantua, where he was tried by a court-martial and shot. His family was indemnified for the loss of their property by the emperor of Austria in 1819, and his son ennobled. The career of Hofer furnished material for tragedies by Immermann and Auerbach. Consult the studies by Heigel (1874) and Stampfer (1891).

HOFF, hŏf, **William Bainbridge**, American naval officer: b. Philadelphia, 1846; d. Washington, D. C., 23 May 1903. He entered the naval service in 1860, and in 1863 was graduated from the Naval Academy. He took part in several naval campaigns during the Civil War, and at the torpedo school and on the United States steamship *Dale* he gave his attention to the instruction of seamen in gunnery. In 1893 he was marine commissioner to Great Britain for the World's Fair at Chicago, and was retired in 1897. He was the author of 'Elementary Naval Tactics'; and 'Avoidance of Collisions at Sea.'

HOFFMAN, hŏf'man, **Charles Fenno**, American poet and novelist: b. New York, 1806; d. Harrisburg, Pa., 7 June 1884. He entered Columbia College, and studied law at Albany, being called to the bar in 1827. In 1830 he became joint editor of a New York journal, and three years later started the *Knickerbocker Magazine*. For many years he edited the *American Monthly Magazine* also. In 1849 his mind began to give way, and from that time till his death he was an inmate of Harrisburg Lunatic Asylum. His first separate publication was 'A Winter in the West' (1835), followed in 1837 by 'Wild Scenes in Forest and Prairie,' and in 1840 by the novel 'Greyslaer: a Romance of the Mohawk,' which met with immediate and remarkable success. An earlier novel, 'Vanderlyn,' appeared in the *American Monthly Magazine* during 1837. Several of his songs have gained great popularity. His published volumes of verse include 'The Vigil of Faith' (1842); 'The Echo' (1844); 'Lays of the Hudson, and other Poems' (1846); 'Love's Calendar, and other Poems' (1848).

HOFFMAN, Eugene Augustus, American Episcopal clergyman: b. New York, 21 March 1829; d. near Plattsburg, N. Y., 17 June 1902. He was educated at Rutgers and Harvard colleges and at the General Theological Seminary. He held successive rectorships at Elizabeth, N. J., Burlington, N. J., Brooklyn, N. Y., and Philadelphia, and in 1879 was appointed dean of the General Theological Seminary, New York, and with others of his family heavily endowed that institution. Dean Hoffman built Christ Church and rectory at Elizabeth, N. J., and also churches at Woodbridge and Milburn, N. J. He was the author of 'Free Churches' (1858); and 'The Eucharistic Week' (1859 and 1893). Consult Riley, T. M., 'Memorial Biography of E. A. Hoffman' (New York 1904).

HOFFMAN, Richard, American pianist and composer: b. Manchester, England, 24 May 1831; d. 17 Aug. 1909. He came to New York in his 16th year. He received early instruction from Rubinstein, Liszt, Thalberg, Döbler and Meyer. After his arrival in America he made a tour of the country as a soloist, and later accompanied Jenny Lind on her tours; he also played with Gottschalk and Von Bülow in New York in 1875. Later he became an important figure in American musical life. He composed music for the piano, songs, anthems, ballads and church music.

HOFFMANN, August Heinrich, ow'goost hīn'rɪʜ hŏf'män, usually known as HOFFMANN VON FALLERSLEBEN, German poet and philologist: b. Fallersleben, Hanover, 2 April 1798; d. Corvei, 19 Jan. 1874. He studied at Göttingen and Bonn, was appointed in 1823 custodian of the university library at Breslau, and in 1830 became extraordinary, in 1835 ordinary professor of the German language and literature in the university of that city. He resigned his librarianship at Breslau in 1838, and in 1842 was removed from his chair without a pension because of the liberal political views represented in his 'Unpolitsche Lieder' (1840–41). He led a wandering life till 1845, when he obtained the right of domicile in Mecklenburg. In 1848 he was granted a pension by the Prussian government, and from 1860 he was librarian to the Duke of Ratibor. Of his original writings the best known are his songs, not a few of which, especially that beginning 'Deutschland, Deutschland über Alles' (1841), have long received emphatic popular approval. For several of them he composed tunes. They were published in several volumes, among these being 'Gedichte' (1827); 'Alemannische Lieder' (1827); 'Hundert Schullieder' (1848); 'Deutsches Volksgesangbuch' (1848); 'Soldatenlieder' (1851); 'Kinderwelt in Liedern,' and 'Alte und Neue Kinderlieder' (1873). A complete edition of his 'Kinderlieder' was prepared by von Donop in 1877. 'Mein Leben' (1868; abridged edition continued to his death, by Gerstenberg, 1892–94), is autobiographical. Consult also the 'Life' by Wagner (1869).

HOFFMANN, Ernst Theodor Wilhelm, German novelist: b. Königsberg, 24 Jan. 1776; d. 24 July 1822. In admiration of Mozart he dropped the name Wilhelm and substituted Amadeus. His childhood and youth were joyless and in 1792 he entered the University of Königsberg to prepare for a legal career. He practised for a short time at Königsberg, removing subsequently to Glogau and in 1798 to Berlin. In 1800 he went to Posen but his powers of caricature cost him his place and caused his virtual banishment to Plozk. His leisure moments were spent in musical composition. In 1804 he removed to Warsaw, where he was influenced by the Romantic writers such as

Novalis, Tieck and Wackenroder. During his sojourn in Warsaw he composed the music to Brentano's ‘Lustige Musikanten’ and to Werner's ‘Kreuz an der Ostzee’ and the opera ‘Liebe und Eifersucht.’ Hoffmann's fortunes were impaired when the French invaded Warsaw, and in 1808 he moved to Bamberg as musical director of a theatre there. This institution became bankrupt and Hoffman turned to literature in order to enhance his scanty earnings as composer and teacher of music. His earliest work was a series of musical sketches, ‘Phantasiestücke in Callots Manier’ (4 vols., 1814). In 1814 he was recalled to Berlin and in 1816 was made councillor of the Court of Appeal. In the latter year appeared his great novel, ‘Die Elixiere der Teufels’ (q.v.), which laid the foundation of his literary fame. Hoffman's habits of dissipation impaired his health and he died of locomotor ataxia at the age of 46. Other works by him are ‘Lebensanischten des Katers Murr’ (1820–22), ‘Die Serapionsbrüder’ (1819) and ‘Nachtstücke’ (1817). His works were recently published (15 vols., 1905). His musical compositions were edited by E. Istel (1906). Translations of all of his important works have appeared in English. Consult Ellinger, G., ‘E. T. A. Hoffmann’ (1894); Hitzig, ‘Hoffmann's Leben und Nachlass’ (Stuttgart 1839); Klinke, O., ‘Hoffmann's Leben und Werke vom Standpunkte eines Irrenarztes’ (1903); Sakheim, Arthur, ‘E. T. A. Hoffmann: Studien zu seiner Personlichkeit und seinen Werken’ (Leipzig 1908); Wolzogen, Hans, ‘E. T. A. Hoffmann und R. Wagner’ (Berlin 1906).

HOFMANN, August Wilhelm von, German chemist: b. Giessen, 8 April 1818; d. Berlin, 5 May 1892. He studied law, obtained the degree of doctor of philosophy, became assistant under Liebig in the Giessen Laboratory, and in 1845 became professor of chemistry in the University of Bonn. The same year he was appointed superintendent of the new Royal College of Chemistry in London, and in 1853 became professor of chemistry in the Royal School of Mines, though still remaining at the head of the College of Chemistry. In 1861 he was elected president of the London Chemical Society, and in 1863 was appointed to the chair of chemistry in the University of Berlin, where he remained till his death. In 1864 he built a laboratory at Bonn and became its director, and in 1868 founded the German Chemical Society. He was judge of several industrial expositions and was a member of many scientific societies, and for his valuable services was ennobled in 1888. A statue of him is in the National Gallery of Berlin. Hofmann's researches contributed much to the development of the color industry and have revolutionized the art of dyeing. He investigated the organic bases of coal-tar and discovered the amines. He discovered a method of transforming acid amides into amines by means of bromine and caustic potash. This method is known as Hofmann's reaction. He also discovered aniline among the products of distilled bituminous coal and methods for the preparation of coloring substances from aniline. Entire departments of organic chemistry have developed from his researches and chemical theory in general has been greatly influenced by his work. He wrote ‘A Handbook of Organic Analysis’ (1853); ‘Introduction to Modern Chemistry’ (1865; and several later editions): this work led to important reforms in methods of teaching chemistry; ‘Zur Errinnerung an vorangegangene Freunde’ (1889); ‘The Life Work of Liebig in Experimental and Philosophic Chemistry’ (1876), etc. Consult Volhard and Fischer, ‘August Wilhelm von Hofmann: Ein Lebensbild, im Auftrage der deutschen chemischen Gesellschaft’ (Berlin 1902).

HOFMANN, Heinrich, German painter: b. Darmstadt, 19 March 1824; d. 1902. In his native town be began his studies as a copperplate engraver, but subsequently under Schadow and Hildebrande turned his attention to painting, to which henceforth he devoted his life. After extensive travels in Europe, which included a residence of four years in Italy in 1854–58, and practising in various German cities, he settled at Dresden in 1862 as professor of painting in the Academy there. The most famous of his pictures are ‘The Burial of Christ’; ‘King Enzio in Prison’; ‘The Betrayal of Christ,’ in the Darmstadt Gallery; ‘The Finding of Christ in the Temple,’ in the Dresden Gallery; ‘Christ Preaching on the Lake,’ in the Berlin National Gallery; ‘Venus and Cupid’; ‘Romeo and Juliet’; ‘Othello and Desdemona’; and ‘Christ in Gethsemane.’ In 1878–79 he decorated the ceiling of the vestibule of the theatre at Dresden with his ‘Apotheosis of the Heroes of the Greek Drama.’ All the creations of Hofmann testify to his sense of refined beauty and are rather remarkable for harmonious coloring and delicacy than for originality of design or composition, as he clings to the tradition of the classic period in the ideal character of his conceptions. His works are popular and have been engraved and photographed more extensively perhaps than those of any German painter of his order.

HOFMANN, Josef, yō'sĕf, Polish pianist: b. Cracow, 20 Jan. 1877. He studied with his father, a professor in the Warsaw Conservatory and director of the Warsaw opera, appeared as a pianist in public at the age of six, became known as one of the most notable of musical prodigies, visited the United States in 1887–88, and was there prevented from playing through the action of the Society for the Prevention of Cruelty to Children. After a period of study, two years of which were spent as a pupil of Rubinstein, he made his début as a virtuoso at Dresden in 1894. His recitals in New York in 1901 showed him to be one of the leading modern pianists. His compositions include some interesting works for the pianoforte. He successfully interprets both the classic, romantic and modern schools. His two handbooks ‘Piano Playing’ and ‘Piano Questions Answered’ are very popular and practical works in their field.

HOFMANNSTHAL, Hugo von, Austrian poet: b. Vienna, 1 Feb. 1874. He belongs to a circle of neo-romantic poets, headed by Stephan George (q.v.), who represent a reaction against the naturalistic movement. Not much is known of his life and very little knowledge of this sort is necessary for the interpretation of his works, as he and his associates sought the salvation of the poetic art in fleeing from the realities of the present day into the romantic dreamland of the past. Hofmannsthal especially is an adept in sensing and reproducing the feelings of characters of by-gone civilizations, especially of the Renaissance. He is a child of wealth, lives in Vienna and has made journeys to France and Italy, in which latter country he spends most of his time in Venice. His works have mostly appeared for the first time in costly prints, accessible only to the few. The poets of this group in most cases printed their works privately. They were intended only for a small circulation among the adherents of this movement, as it was held that only they were capable of appreciating them. To understand the aims and theories of this coterie of poets, it is necessary to read their private journal *Blätter für die Kunst*. Hofmannsthal's masters were Keats, D'Annunzio and Swinburne.

His first work, 'Gestern' (1892), was written when he was but 18 years old. It is in dramatic form but largely lyrical in content. A woman deceives her husband and he discovers her deceit. That is the whole content except the delicate, melidious language of the verse, which was to Hofmannsthal everything. In these lyric-epic verses his real talent is shown. This same word-painting, this same perfection of studied and learned beauty is found in all his earlier dramas, of which 'Der Tor und der Tod' (1893); 'Der Tod des Tizian' (1892), and 'Der Abenteurer und die Sängerin' (1899), are the most important. There is lacking all dramatic action, but one is fascinated by the sweet melancholy of the verse of this master-painter of words.

In his later works there is evident more of a tendency to naturalism. This is seen in 'Electra' (1903), a free imitation of Sophocles, 'Das gerettete Venedig' (1904), in which he followed Thomas Otway, and 'Ödipus und die Sphinx' (1905). Here we find a naturalism based upon the brutal instincts of the senses. No dramatic talent is shown. There is only a mixture of pleasing sound of musical words together with a sensuous mysticism. Other works of Hofmannsthal are 'Die Frau im Fenster' (1899); 'Die Hochzeit der Sobeide' (1899); 'Der Kaiser und die Hexe' (1900); 'Das Bergwerk zu Falun' (1900); 'Das kleine Welttheater' (a puppet play, 1903); 'Odipus der König' (1907); 'Ausgewählte Gedichte' (1903); 'Das Märchen der 672. Nacht und andere Erzählungen' (1905); 'Unterhaltungen über literarische Gegenstände' (1905); 'Prosaische Schriften' (1907); 'Jederman, ein altes Spiel erneuert' (1912); 'Ariadne auf Naxos' (1912), and 'Der Rosenkavalier,' an opera libretto with music by Richard Strauss, performed in New York in 1913. Consult Sulzer-Gebing, Emil, 'Hugo von Hofmannsthal, eine literarische Studie' (Leipzig 1905); Seiberth, Philip, in 'German Classics' (Vol. XVII, New York 1914). See ELECTRA.

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HOG-FEEDING. See NUTRITION OF FARM ANIMALS.

HOGAN, John Joseph, American Roman Catholic bishop: b. Bruff, County Limerick, Ireland, 10 May 1829; d. 21 Feb. 1913. He came to Saint Louis, Mo., in 1848, studied at the Roman Catholic theological seminary there, was ordained priest in 1852, and built and became pastor of Saint Michael's Church of Saint Louis. In 1868 he was consecrated bishop of Saint Joseph, Mo., and in 1880 was transferred to the see of Kansas City.

HOGARTH, hō'gärth, **David George,** English archæologist: b. Barton-on-Humber, Lincolnshire, 23 May 1862. He was educated at Oxford and has since conducted excavations at Paphos, Alexandria, Fayum and elsewhere in the East. He was director of the British School at Athens 1897–1900, was appointed keeper of the Ashmolean Museum, Oxford, 1909 and has published 'Devia Cypria' (1890); 'Modern and Ancient Roads in Asia Minor' (1892); 'A Wandering Scholar in the Levant' (1896); 'The Nearer East' (1902); 'The Penetration of Arabia' (1904); 'Ionia and the East' (1909); 'Accidents of an Antiquary's Life' (1910); 'The Ancient East' (1914).

HOGARTH, William, English painter and engraver: b. London, 10 Nov. 1697; d. there, 25 Oct. 1764. He studied art at Sir James Thornhill's school, James street, Covent Garden. About 1720 he set up for himself, and designed plates for booksellers, the chief of which are the illustrations to Gray's edition of 'Hudibras' (1726). He had ample employment for what are called "conversation pieces," that is, groups of family portraits, united by some common occupation or interest, but never cared greatly for this branch of art. In March 1729 he married clandestinely the daughter of Sir James Thornhill, and shortly afterward began to display his extraordinary faculty for depicting the vices and follies of his time. In 1730–31 he painted 'A Harlot's Progress,' a series of six pictures, like many of his other works, engraved by himself. It was published in April 1732. The 'Harlot's Progress' was followed by other satiric delineations, such as 'A Midnight Modern Conversation' (1734); 'Southwark Fair' (1735); 'A Rake's Progress' (1735); 'The Distrest Poet' (1736); 'The Four Times of the Day,' and the 'Strolling Actresses Dressing in a Barn' (1738). With less success he also produced the large canvases still in Saint Bartholomew's Hospital — the 'Pool of Bethesda' and the 'Good Samaritan,' both executed in 1736; and also painted several portraits. The series of graphic satires was, however, continued by the 'Enraged Musician' (1741) and the famous 'Marriage à la Mode' (his masterpiece), six pictures now in the National Gallery, and engraved by various hands in 1745. 'Industry and Idleness,' 12 plates, followed these in 1747; 'Calais Gate' (1749) came next, and in 1750 the fine plate known familiarly as the 'March to Finchley.' The minor plates of 'Beer Street' and 'Gin Lane' and the set called 'The Progress of Cruelty' belong to 1751. In 1753 Hogarth published his 'Analysis of Beauty,' a treatise containing many shrewd remarks but confused and illiterate in style and the cause of much ridicule. After this he produced (with the aid of Grignion and others) the four prints of the 'Election Series' (1755–58), the 'Cockpit' (1759), etc. In 1762–63 he became involved in a miserable quarrel with Wilkes and Churchill, the result of which, on his side, was the well-known portraits of Wilkes, and of Churchill as a bear ('The Bruiser'). Most of Hogarth's pictures, which now enjoy a much higher repute for technique than formerly, are preserved in public or private collections in Great Britain. He was entirely uninfluenced by foreign art. His powers of invention and combination were extraordinary; and as a humorist and social satirist with the pencil he has never been surpassed. There can be no doubt also that he genuinely desired to assist by his work in the reformation of manners. Consult the biographies by Sala (1866), and Dobson (1879).

HOGBACK. See Cuesta.

HOGE, hōg, **Moses Drury,** American Presbyterian clergyman: b. Hampden-Sidney, Va., 17 Sept. 1819; d. Richmond, Va., 1899. He was graduated at Hampden-Sidney College and Seminary and was pastor of the Second Presbyterian Church in Richmond, Va. (1845–85). He ran the blockade in a ship from Charleston during the Civil War and secured from England a large number of copies of the Holy Scriptures for distribution among the Confederate soldiers, the British and Foreign Bible Society making a special grant at his request. After the war he was instrumental, especially during the session in 1874 of the Southern Presbyterian Church, in reconciling differences with the Northern Presbyterian Church.

HOGG, James, Scottish poet, familiarly known as «The Ettrick Shepherd»: b. Ettrick, Selkirkshire, 25 Jan. 1770; d. Altrive, on the Yarrow, 21 Nov. 1835. After receiving a very scanty education, he began to earn his bread by daily labor as a shepherd. His early rhymings brought him under the notice of Sir Walter Scott, by whose advice he published a volume of ballads called 'The Mountain Bard.' He then went to Edinburgh, where he published the 'Forest Minstrel' (1810), and started a weekly periodical entitled *The Spy*. The appearance of the 'Queen's Wake' in 1813, with its charming ballad of Kilmeny, established Hogg's reputation as a poet. In 1815 he published 'Pilgrims of the Sun,' followed by 'Mador of the Moor'; the 'Poetic Mirror' (a collection of imitations of living poets); 'Queen Hynde,' and 'Dramatic Tales,' as well as by 'The Brownie of Bodsbeck,' etc. From 1817 he held the farm of Altrive from the Duke of Buccleuch at a merely nominal rent; but his farming schemes never throve, and he was generally in narrow circumstances.

HOGNOSE, a North American colubrine serpent (*Heterodon platyrhinus*), so called because of its upturned pig-like snout. It is usually about two feet long, gray marked with brown bars, but sometimes is so dark that the whole surface appears blackish; it dwells and seeks its prey mainly in the woods and thickets. When alarmed — and it is extremely timid — it hisses violently (whence other rustic names such as «blowing-adder»), and expands and flattens the head and neck by inhaling air and stretching out the ribs, giving itself a most ugly aspect. If these tactics do not succeed in terrifying the enemy sufficiently, the snake begins a series of astonishing contortions and twistings which end in the animal throwing itself upon its back and seeming dead until a chance of escape offers. Two or three other species are known in the South and West, all of which are regarded as poisonous by most country people, but are really quite harmless.

HOGS. See Swine.

HOGSHEAD, a liquid measure formerly in use in England. Its capacity varied in different cases. For beer it was 54 gallons, for rum 45 to 50 gallons, for brandy 45 to 60 gallons and for different kinds of wine it varied from 46 to 93 gallons. In the United States the measure is still in use, being equivalent to 63 American gallons or 52.485 imperial gallons; for tobacco it varies from 750 pounds in some States to 1,200 pounds in others.

HOHENLINDEN, ho-ĕn-lĭn'dĕn, Germany, village of Bavaria, 20 miles east of Munich, celebrated for the victory gained by the French under Moreau over the Austrians under the Archduke John, 3 Dec. 1800. Moreau placed his army on the plain between the Inn and the Isar, thus barring the way to Munich, the objective of the Austrians. When the latter advanced Moreau simply held them in check and sent Richepanse around their flank to attack them in the rear. When Richepanse began his rear attack, Ney was ordered to attack the Austrians in front, who were thus caught and crushed between two forces. The Austrians left 10,000 dead on the field, while the French loss was only about 5,000. The French took nearly 80 pieces of cannon, 200 caissons and more than 10,000 prisoners, with three general officers. The French victory led to the treaty of peace concluded at Lunéville, 9 Feb. 1801.

HOHENLOHE - SCHILLINGSFÜRST, hō-ĕn-lō'ė shĭl'lĭngs-fürst, **Chlodwig Karl Victor,** Prince von, German Chancellor: b. Rotenburg-an-der-Fulda, March 1819; d. Ragatz, Switzerland, 6 July 1901. He took courses in law and political science at Heidelberg, Göttingen and Bonn. He entered public life and became in 1866 Prime Minister of Bavaria. In 1874 he was German Ambassador to France and in 1885 became governor-general of Alsace-Lorraine. In 1894 he was appointed Chancellor and resigned in 1900.

HOHENSTAUFEN, hō'ĕn-stow-fĕn, **House of,** a German dynasty reigning from 1138 to 1254. After the death of the emperor, Henry V (1125), his two nephews, Frederick II, Duke of Swabia, and Conrad, Duke of Franconia, aspired to the German crown; but were opposed by the directors of the election, the archbishop of Mayence and the papal legate; and Lothaire of Saxony was elected. The circumstance, with the demand made by the new emperor of the restitution of all the possessions acquired by the lords of Hohenstaufen during the preceding reign, produced a fierce war between the emperor and the two brothers. Lothaire preserved himself by a union with Henry the Proud, Duke of Bavaria, to whom he gave his daughter and the duchy of Saxony. The Peace of Mühlhausen (1135), between Lothaire and Conrad, put an end to this Ten Years' War. Conrad renounced his title of king of Italy which he had taken, but received the first rank among the dukes, and both he and his brother regained all their lands. After Lothaire's death (1137) Conrad, Duke of Franconia, of the house of Hohenstaufen, was raised to the throne of Germany, with the title of Conrad III. After the death of Conrad III (1152) the confidence which was felt in the Hohenstaufen family caused the choice to fall on his nephew, Frederick III of Swabia, called Barbarossa (the Red-beard), who was followed by Henry VI (1190), and he again by Otto IV (1197) and Frederick II (1215–50), all belonging to the same house. After the death of Frederick II his son Conrad was acknowledged as his successor, with the title of Conrad IV, by most of the states of the empire; but Innocent IV laid him under an interdict and declared him to be deprived of all his lands. The conflict between Conrad and the Pope lasted until the latter's death in 1254. The fame of the house of Hohenstaufen is based upon the political greatness to which the Fredericks in particular attained; their success in reducing to order all the states of the empire; the encouragement which they gave to commerce and trade and their efforts to promote the sciences and arts.

HOHENZOLLERN, hō′ĕn-tsŏl-lĕrn, Germany, province of Prussia, formed in 1849 by the union of the two principalities of Hohenzollern-Hechingen and Hohenzollern-Sigmaringen. It consists of a narrow irregular strip of country encircled by Würtemberg and Baden. Area 441 square miles; pop. (1911) 71,011. The province is traversed by the Danube and the Neckar. Iron, coal, gypsum, peat and rock salt are found in the mountains, and the valleys yield fruit, grain and hops. There are several mineral springs. Cotton spinning, iron founding, agriculture and cattle raising are the principal industries. Sigmaringen is the seat of the Landtag since 1873. The province is represented in the Reichstag by one deputy. The inhabitants are nearly all Roman Catholics, under the jurisdiction of the archdiocese of Freiburg. The princely family of Hohenzollern dates from Thassilo, Count of Zollern, who died about 800 A.D., after having founded a castle near Hechingen, on the Zollern hill in the Swabian Alps. The fine Hohenzollern castle of 14th century architecture, built in the latter half of the 19th century, occupies the site of the ancient family-seat. There have been several lines and branches of the Hohenzollerns, the first separation taking place about 1165, when Frederick IV founded the elder or Swabian and Conrad III the younger or Franconian line. The elder line was subdivided, in 1576, into the branches of Hechingen and Sigmaringen. Frederick VI, the representative of the younger line, in 1415 received from the Emperor Sigismund the investiture of the electorate of Brandenburg, thus founding the reigning dynasty of Prussia. The two branches of the elder line continued unbroken till 1849, when the reigning princes ceded their respective rights and principalities to the king of Prussia, who in 1871 became German Emperor. The main branch of the Hohenzollerns is represented by the former imperial family of Germany. See Germany.

HOHENZOLLERN CANAL, Germany, running from Berlin to the river Oder, thus connecting the capital with Stettin by water, was opened by Kaiser Wilhelm II on 17 June 1914.

HOISTING APPARATUS. See Crane; Derrick; Elevator.

HOJO. A line of rulers in Japan (1219–1333) who, though historically considered as usurpers, were the regents and real executives of the country from 1200 to 1333. Descended from Imperial and Taira ancestors, they were men of ability. They made Kamakura their seat of power and virtual capital of the empire and set up and deposed both emperor and shogun at their will. They were finally driven from power by Nitta Yoshisada, in 1333, and Kamakura was burned and left desolate. Their chief claim to honorable fame lies in the energy shown by the regents Tokimune and Yasutoki in driving off the Mongols, when they attempted invasion. This era furnishes the theme of much Japanese fiction and many art motives. To reinforce the national spirit, when the Russian War of 1904–05 was at its height, the Mikado conferred high posthumous honors upon Hojo Yasutoki (1183–1242), for his defeat of the Mongols and the vindication of Japanese Bushido in keeping Japan inviolate. Consult Murdoch and Yamagata, ‘History of Japan’ (1905); Yamada, ‘Ghenko; the Mongol Invasion of Japan’ (1916); Griffis, ‘The Mikado's Empire’ (1912); and, in fiction, Fraser, ‘A Stolen Emperor’ (1903).

HOKE, Robert Frederick, Confederate general: b. Lincolnton, N. C., 27 May 1837; d. Raleigh, N. C., 1906. He was educated at the Kentucky Military Institute and at the beginning of the Civil War enlisted in the Confederate army as a private, soon being promoted to the rank of colonel. He took part in the early battles around Richmond, served in North Carolina, on 17 Jan. 1863 was commissioned brigadier-general, and was seriously wounded at Chancellorsville. As a reward for capturing Plymouth, N. C., he was promoted to major-general, 20 April 1864, and assigned to the command of a division of the Army of Northern Virginia. From May to December, 1864, he fought in front of Richmond, serving with distinction at Cold Harbor, where his command bore the brunt of the fighting. For a short time afterward he commanded the district of North Carolina; in 1865 took charge of a division of J. E. Johnston's army; at Bentonville (q.v.) fought his last battle; and surrendered at Durham Station, N. C., 26 April 1865. After the war he engaged in the iron business in North Carolina and later became president of the Seaboard Air Line system. In 1898 President McKinley offered him a commission as major-general of volunteers in the war with Spain but he declined.

HOKUSAI, hō-koo-sä′ē. See Japanese Art.

HOLACANTHUS. See Butterfly-fish.

HOLBACH, Paul Heinrich Dietrich, powl hīn′riH dēt′riH hōl′bäH (Fr. ōl-bäk), Baron von, German philosophical writer: b. Heidelsheim, in the Palatinate, 1723; d. Paris, 21 June 1789. He was educated in Paris, where he passed the greater part of his life. He was the centre of a circle of men of wit but of freethinking principles, using his great fortune, says Rousseau, generously, and appearing to advantage in the learned society which he gathered round his table. He was the author of a great number of works, most of which were anonymous or pseudonymous. The principal work attributed to him, which appeared in 1770 under the name of M. Mirabaud, and excited much attention in the learned world, is the ‘Système de la nature.’ He afterward published ‘Système social’ — a development of the previous work, showing the application of the principles promulgated in it to morals and politics; ‘Bons Sens, or Idées naturelles opposées aux Idées surnaturelles’; ‘Eléments de la morale universelle,’ etc. According to Holbach matter is the only form of existence, and everything is the effect of a blind necessity. Consult Hall, E. V., ‘The Friends of Voltaire’ (1907).

HOLBEIN, Hans, hänts hŏl- or hōl'bīn, THE ELDER, German painter: b. Augsburg, 1460; d. Alsace, 1524. His art training began under the influence of Martin Schongauer, but he quickly launched out into a new style, which left ancient precedents behind. He developed a dramatic energy, a clear and lifelike coloring and pre-eminent distinction of expression which rendered him the acknowledged head of a new school. His figures took the attitude of life. The pictures over the altar in the cathedral at Augsburg, painted in 1493, are good specimens of his best work; in them are portrayed incidents in the life of Virgin Mary. To the same class belong the remains of an altarpiece in the Dominican church at Frankfort-on-Main, representing scenes of the Passion (1501); 16 paintings of the Passion in the Munich Gallery; the portrait of the artist with his two sons, in the gallery at Augsburg. His later pictures show traces of the influence exercised by the Italian Renaissance, and those painted about 1512 and later are vastly superior to his early work. Among them is his ‘Fount of Life’ (1519), now in the royal gallery at Lisbon; the altarpiece ‘Saint Sebastian’ (1515), at Augsburg; the altarpiece ‘Saint Katharine,’ in the same gallery, etc. In such works the bold and devotional conception, delicacy and directness of expression, ease of drawing and splendor of coloring, are beyond praise. Excellent also are some of his preliminary sketches and outlines, and in Basle, Berlin and Copenhagen are collections of his pencil sketches, the most remarkable of which is that at Berlin. Consult Woltmann, ‘Holbein und seine Zeit’ (1866), and the monograph by A. B. Chamberlain (1905; new ed., 2 vols., London 1913).

HOLBEIN, Hans, THE YOUNGER, German painter: b. Augsburg, 1497; d. London, Nov. 1543. He probably received instruction in painting from his father, and about 1515 went to Basle, where he engaged in illustrating books. At Basle he also painted his earliest portraits, and in 1517 went to Lucerne. Here he painted the house of Jacob von Hertenstein, designed windows, and executed other works. Returning to Basle in 1519, he became a burgher in the following year, and during a seven years' residence in that city he executed many works of great importance. In 1526 he went to England. Letters from his friend Erasmus, whose famous ‘Praise of Folly’ he had illustrated, procured him the patronage of the chancellor, Sir Thomas More, who employed him to delineate the portraits of most of his own personal friends about the court, and introduced him to the notice of Henry VIII, who was a liberal encourager of the fine arts. Among the portraits produced by him during this period are those of More, Archbishop Warham and Bishop Fisher. From 1528 till 1532 he was again in Basle, but in the latter year he returned to England, where he was destined to spend nearly all the remainder of his life. Holbein painted most of the principal English nobility, whose portraits place him among the world's greatest portrait-painters. Some of his earlier productions, especially his ‘Dance of Death,’ are also celebrated. In 1538 he completed and published this series. Among the pictures of Holbein's last period are ‘The Ambassadors’ (1533), and portraits of Hans of Antwerp (1532), English Lady and Gentlemen (1534), Sir Richard Southwell (1538), Duke of Norfolk (1539), Thomas Cromwell, Lady Jane Seymour, Henry VIII (1542, unfinished), and others. Comparatively few of Holbein's pictures are still extant in England, great numbers of them having been destroyed by Puritan fanatics, or sold and dispersed over Europe. Many of them also perished in the great fire in London in 1666. Holbein also excelled in wood-engraving, and before his visit to England had produced a large number of wood-cuts. He was one of the earliest to paint portraits in miniature. Consult Woltmann, ‘Holbein und seine Zeit’ (1874); Knackfuss, ‘Holbein der Jüngere’ (1896), and monographs by A. B. Chamberlain (1913), Davies (1903), and Wornum (1867).

HOLBERG, Ludwig, lood'vĭg hŏl'bĕrg, BARON, Danish author: b. Bergen, Norway, 3 Dec. 1684; d. Copenhagen, 28 Jan. 1754. He studied at Copenhagen, Oxford and Paris, and after paying a six months' visit to Rome returned to Copenhagen in the end of 1716. In 1718 he was appointed to an ordinary professorship in the university of that city, where after this date he chiefly resided till his death. In 1735 he was unanimously elected rector, and in 1737 treasurer of the university, and in 1747 was raised to the rank of baron. Holberg's numerous productions in various departments of literature as well as the important and salutary influence which he exercised upon his countrymen place him in the front rank of the literary men of his age. He is considered the greatest of Danish authors, and the founder of its literature. He was extremely versatile — now devoted to history, now to poetry and now to the drama; but during his whole life he was a sworn enemy to pedantry, theological disputatiousness and scholastic metaphysics. His works may be divided into four classes — poems, stage pieces, philosophical treatises and historical works. His poems are chiefly of a satirical nature. The most celebrated among them is ‘Peder Paars,’ a comic heroic poem in 14 cantos, still regarded throughout the Scandinavian countries as a masterpiece, and the hero of which has become the national comic impersonation in Denmark. It has been translated into several languages. Almost equally famous is his ‘Nicholas Klimm's Subterraneous Travels,’ a satirical romance in prose, originally written in Latin, but translated into seven modern European languages shortly after it appeared, into Danish first by Baggesen (1789). His numerous stage pieces are either comedies or farces, and nearly all characterized by true comic power. In ‘Erasmus Montanus’ (q.v.), Holberg attacks the pedantry and scholasticism so characteristic of the university life of his day. Among his philosophical writings the most important is his ‘Moral Reflections’ (1744). His historical works include

‘The Political, Ecclesiastical and Geographical Condition of the Danish Monarchy,’ a work of great value as a source of reference; ‘A General History of the Jews,’ and ‘A History of Famous Men and Famous Women’ (1739–45). Consult ‘Lives’ by Smith (Copenhagen 1858); and Brandes (1884).

HOLBORN, ho-burn, England, a metropolitan borough in central London. Area, 405 acres, the smallest of the boroughs. Here, in Saint Giles in the Fields and Seven Dials, are the lowest strata of London; but Halton Garden, on the other hand, is the centre of the diamond trade. The ancient chapel of Saint Etheldreda, built in the Decorated style, was acquired by the Roman Catholics in 1874, and is now restored for public worship. The City Temple, belonging to the Congregational body, is another important religious edifice. Lincoln's Inn and Gray's Inn, incorporated schools of law, are within the borough. Pop. 49,357. Consult Milton, ‘Holborn,’ in the ‘Fascination of London’ series.

HOLBROOK, John Edwards, American naturalist: b. Beaufort, S. C., 30 Dec. 1794; d. Norfolk, Mass., 8 Sept. 1871. He was graduated from Brown in 1815, from the medical school of the University of Pennsylvania in 1818, began practice at Charleston, S. C., in 1822, and in 1824 was appointed to the chair of anatomy in the Medical College of South Carolina, a post he held for over 30 years. In the Civil War he was head of the South Carolina examining board of surgeons. His ‘American Herpetology, or a Description of Reptiles Inhabiting the United States’ (1842), won for him recognition among European scientists. He published but 10 numbers of his ‘Ichthyology of South Carolina’ (1854 et seq.), when the Civil War compelled its discontinuance.

HOLCOMB, Silas Alexander, American jurist: b. in Gibson County, Ind., 25 Aug. 1858. He received a common school training, studied law in Nebraska, was admitted to the bar in 1882, and in 1891 was made judge of the 12th judicial district. He was governor of Nebraska from 1894 to 1898, having been elected by fusion of the Populist and Democratic voters. He was justice of the Supreme Court of Nebraska 1900–06 and chairman of the Board of Commissioners of State Institutions since 1913.

HOLCOMBE, Chester, American diplomatist and author: b. Winfield, N. Y., 16 Oct. 1844; d. 25 April 1912. He was graduated at Union College in 1861; and served as interpreter and secretary to the United States legation in China, 1871–85. He was acting Minister in 1875–76, 1878–79 and 1881–82. Becoming an authority on the Chinese and Chinese affairs, in 1896 he acted for the Chinese government in its financial embarrassments, preparing the Chinese and English documents for the government loan of $100,000,000, and drawing up in both languages the details for the construction of 3,000 miles of railroads in China. In 1902 he lectured at Lowell Institute, Boston. He has published ‘Travels in Western China’ (1875); ‘The Practical Effect of Confucianism upon the Chinese Nation’ (1882); ‘Catalogue and Handbook of Antique Chinese Porcelains’ (1890) ‘The Real Chinaman’ (1895); ‘The Real Chinese Question’ (1899); ‘China's Past and Future’ (1904); and in Chinese he wrote ‘A Mental Arithmetic’ (1873); ‘Life of Christ’ (1875), and a translation of the American Declaration of Independence.

HOLDEN, Edward Singleton, American astronomer: b. Saint Louis, Mo., 5 Nov. 1846; d. 16 March 1914. He was graduated at Washington University in 1866, and at the United States Military Academy in 1870; was professor of mathematics at the Naval Academy in 1873–81; and director of the Washburn Observatory (Madison, Wis.) in 1881–85. In 1885–87 he was president of the University of California and in 1888–98 director of the Lick Observatory, on Mount Hamilton, San José, Cal. It was in connection with the Lick Observatory that his most important work was done, and his services to astronomy found recognition in America and from European states. Most of the buildings and instruments at the Lick Observatory were designed by him. He became librarian of the United States Military Academy in 1901. Among his publications are ‘Bastion System of Fortification’ (1872); ‘Index Catalogue of Nebulæ’ (1877); ‘Life of Sir William Herschel’ (1881); ‘Astronomy’ (with S. Newcomb, 1892); ‘Mountain Observatories’ (1896); ‘Essays in Astronomy’ (1900); ‘Elementary Astronomy’ (1900); ‘The Sciences’ (1903); ‘Galileo’ (1905).

HOLDEN, Sir Isaac, English inventor: b. Hurlet, near Paisley, 7 May 1807; d. Keighley, Yorkshire, 13 Aug. 1897. While a worker in a cotton mill in Paisley he fitted himself for the post of a teacher. While conducting an experiment he discovered the lucifer match, previously, however, invented by John Walker of Stockton-on-Tees. Subsequently he was manager, then owner of a wool-combing establishment, and by his mechanical improvements made significant changes in that industry. His shops at Bradford, with branches at Croix and Rheims, eventually became the largest of the kind in the world. He was several times elected to Parliament in the Liberal interest, and was created a baronet in 1903.

HOLDER, hōl'dėr, **Charles Frederick**, American naturalist: b. Lynn, Mass., 5 Aug. 1851; d. 11 Oct. 1915. He studied at the United States Naval Academy, but resigned in 1871; in 1871–75 was assistant curator of the American Museum of Natural History, from that time turned his attention to lecturing and literary work, and became known as a leading writer on popular science. At Pasadena, Cal., whither he removed in 1885, he became president of the board of education, professor of zoology in Throop University and honorary curator of the university museum. Among his publications are ‘Marvels of Animal Life’ (1880); ‘Elements of Zoology’ (1885); ‘Living Lights’ (1887); ‘Frozen Dragon’ (1888); ‘A Strange Company’ (1889); ‘Around Pasadena’ (1889); ‘Santa Catalina Island’ (1889); ‘Louis Agassiz, his Life’ (1892); ‘Darwin's Life and Work’ (1893); ‘The Treasure Divers’ (1898); ‘Along the Florida Reef’ (1892); ‘Stories of Animal Life’ (1900); ‘Half-Hours with Nature’ (1901); ‘The Boy Anglers’ (1904); ‘Half Hours with the Lower Animals’ (1905); ‘Life in the Open’ (1906); ‘Log of a Sea Angler’ (1906); ‘Big Game at Sea’ (1908); ‘The Marooners’ (1909); ‘The

Channel Islands' (1910); 'Distinguished American Scientists' (1911); 'Game Fishes of the World' (1911); 'The Ocean' (1913); 'Angling Adventures Around the World' (1914).

HOLE, Samuel Reynolds, English Anglican clergyman: b. Ardwick, Manchester, 5 Dec. 1819: d. Rochester, England, 27 Aug. 1904. He was educated at Oxford, took orders, was ordained in 1845 and was vicar of Caunton, 1845–87. From 1887 he was dean of Rochester Cathedral. He visited the United States on a lecture tour in 1896, where his humorous, anecdotical lectures were very popular. He was a recognized authority on rose culture and wrote 'A Book about Roses,' which has reached its 15th edition; 'The Memories of Dean Hole'; 'More Memories'; 'Addresses to Working Men'; 'A Little Tour in America'; 'Our Gardens'; 'Then and Now,' etc. Consult the Memoir by G. A. B. Dewar prefixed to his 'Letters' (1907).

HOLE, William, English painter: b. Salisbury, 7 Nov. 1846. He was destined for the profession of engineering but after a journey to Italy turned his attention to art. He studied at the Edinburgh School of Art, and in 1889 was elected member of the Royal Scottish Academy. His versatility is shown by the excellence of his work in portrait, genre and fresco, while as an engraver he has made many famous plates after such masters as Millet, Constable and Millais. Among his best-known paintings are 'The End of the Forty-five' (1879); and 'News of Flodden' (1886); and a series of 80 water colors, 'The Life of Jesus of Nazareth.' He executed a series of remarkably fine mural paintings illustrative of Scottish history for the National Portrait Gallery, Edinburgh (1900), and another for the municipal buildings in that city (1903).

HOLGUIN, ōl-gēn', Cuba, city in the province of Oriente, about 25 miles by rail south by west of Gibara, its port, and 70 miles northwest of the city of Santiago de Cuba. Fertile agricultural lands are in the vicinity; also on the southwest is a hilly section bordering on the interior mountain range. A noted cave is in the vicinity. The trade is chiefly in sugarcane, tobacco, timber, corn and cattle. It was settled in 1720 and became a city in 1751. Pop. 7,592.

HOLIBUT. See HALIBUT.

HOLIDAY, any day set apart as a religious or national festival. (See FESTIVALS). Certain days are fixed by law as bank-holidays for England and Scotland, and it is enacted that all business transactions which would have been valid on any such holiday shall be held as valid if performed on the day following. Thus, when a bill of exchange becomes due, or notice of dishonor fails to be given, on a bank-holiday, the bill is payable or the notice stands good on the following day. The days fixed for England are Easter Monday, the Monday in Whitsun Week, the first Monday in August and the 26th of December if a week-day. These are in addition to Christmas Day, Good Friday and other holidays previously established. The days fixed as bank-holidays for Scotland are New Year's Day, Good Friday, the first Monday of May, the first Monday of August and Christmas Day; and if either New Year's Day or Christmas Day falls on a Sunday, the Monday after is held as a holiday. The same act empowers the sovereign to appoint by proclamation a special day to be observed as a bank-holiday, and to alter by order in council any of the days settled by the act.

In the United States there is no national holiday, not even 4 July. The 53d Congress passed an act making Labor Day a public holiday in the District of Columbia, and various States have followed with a similar act. The proclamation of the President designating a day of Thanksgiving makes it a legal holiday only in the District of Columbia and in the Territories. New Year's Day is a legal holiday in all the States and in Porto Rico and Hawaii. Lincoln's birthday (12 Feb.) is a legal holiday in Arkansas, California, Colorado, Connecticut, Delaware, Illinois, Indiana, Iowa, Minnesota, Montana, Nebraska, Nevada, New Jersey, New York, North Dakota, Oregon, Pennsylvania, South Dakota, Washington, West Virginia and Wyoming. Washington's birthday (22 Feb.) is a legal holiday in all the States and in Porto Rico and Hawaii. Decoration Day (30 May) in all the States except Arkansas, Florida, Louisiana, Michigan, Mississippi, North Carolina, South Carolina and Texas. Independence Day (4 July) in all the States and Territories. Labor Day (in general, the first Monday in September) in all the States and in Porto Rico and Hawaii. Election Day and Christmas Day are generally observed as legal holidays in all the States and Territories. There are various States holidays, such as Patriot's Day (19 April) in Maine and Massachusetts, Pioneer's Day (16 Aug.) in Utah, All Saints' Day (1 Nov.) in Louisiana, Admission Day (9 Sept.) in California, and Confederate Memorial Day (10 May) in North and South Carolina. Every Saturday after 12 o'clock noon is a legal holiday in many of the States and cities and in the District of Columbia and the Territories. In Canada eight public holidays are generally observed exclusive of Thanksgiving Day — New Year's Day, Good Friday, Easter Monday, Victoria Day, King's Birthday, Dominion Day and Labour Day; but in the province of Quebec there are others in addition, chiefly Church anniversaries.

HOLINSHED, hŏl'ĭnz-hĕd, **Raphael or Ralph**, an English chronicler: d. about 1580. He is only known by his 'Chronicles of Englande, Scotlande, and Irelande,' the first edition of which, known as the "Shakespeare edition," because it is the one the poet is supposed to have used in collecting material for his historical plays, was published in London in 1577. In the preparation of this work Holinshed was assisted by several of the most learned men of the day.

HOLL, Frank, English portrait and genre painter, son of Francis Holl, an eminent engraver; b. London, 4 July 1845; d. there, 31 July 1888. He was a very successful student at the Royal Academy, and exhibited constantly from his student days. Among his best-known pictures are 'Faces in the Fire'; 'Fern-Gatherers'; 'No Tidings from the Sea'; 'Leaving Home' and the 'Gifts of the Fairies' In the later portion of his career he devoted himself to portraiture, in which he greatly excelled, and painted many of the celebrities of the day.

HOLLAND, Edmund Milton, American actor: b. New York, 7 Sept. 1848; d. 24 Nov. 1913. He began his professional career at Barnum's Museum in 1866, was later for 13 years a member of Lester Wallack's Company, and as a member of the Madison Square Company from 1882 created the parts of Captain Redwood in 'Jim the Penman,' Colonel Moberley in 'Alabama' and the title rôle in Colonel Carter of Cartersville.' In 1895–97 he starred with his brother Joseph, and later (1901) appeared as Eben Holden in the dramatization of Irving Bacheller's book of that name. In 1903–06 he appeared in 'Raffles' as Captain Bedford. He became a member of the New Theatre Company in 1909, and in 1909–11 appeared successively as Sir Oliver Surface in 'The School for Scandal,' Canon Bonington in 'Don,' Mr. Elkin in 'The Thunderbolt,' Gaffer Tyl in 'The Blue Bird' and Baron Von Haugh in 'Old Heidelberg.' In 1912 he appeared in 'Years of Discretion' as Metz. Consult McKay and Wingate, 'Famous American Actors of To-Day' (New York 1896) and Strang, L. C., 'Famous Actors of the Day in America' (Boston 1900).

HOLLAND, Henry Richard Vassall Fox, 3d Lord, English statesman: b. Wiltshire, 21 Nov. 1773; d. 22 Oct. 1840. He succeeded to the peerage by the death of his father when less than one year old. In 1798 he took his place in the House of Lords, and as the nephew of Charles James Fox was at once acknowledged as a Whig leader. In 1806 he was commissioner for settling disputes with the United States; was lord privy seal in 1806–07; and chancellor of the duchy of Lancaster. He made Holland House the resort of the wit, talent and beauty of his day. He was the author of 'Life of Lope de Vega' (1806); 'Three Comedies from the Spanish' (1807); 'Foreign Reminiscences' (1850); 'Memoirs of the Whig Party' (1852).

HOLLAND, John Philip, American inventor: b. Liscannor, County Clare, Ireland, 1841; d. 12 Aug. 1914. He was educated at the Christian Brothers' School, Limerick, taught school for 15 years in Ireland and America. As one of the most successful designers in the interesting field of submarine navigation, Holland is well known. His first boat was built in 1875; a second was launched in 1877 and a third in 1881. After a series of severe tests, the Holland boat was ordered by the United States government for the navy in 1900. In 1903 eight of the submarines were put in commission. These have a speed varying from 8.87 to 8 knots, a horsepower of 160 (with one exception), and a displacement in general of 122.55 tons. For some time the inventor was interested in the Holland Submarine Boat Company, but from this he retired to devote his time independently to submarines and flying devices. His later designs called for smaller and more compact vessels, with much less complicated mechanism, power of remaining longer submerged and increased safety in operation. See Submarine Navigation, History of.

HOLLAND, Josiah Gilbert, American editor and author: b. Belchertown, Mass., 24 July 1819; d. New York, 12 Oct. 1881. He began the study of medicine in 1840, in 1844 was graduated from the Berkshire Medical College, and entered practice at Springfield, Mass. The years that followed were discouraging, for patients did not come to the young doctor. With true Yankee versatility he turned his hand to anything,— taught district school, was a traveling writing-master and a daguerreotypist. Of his boyish mortification at being a mill hand he has written in 'Arthur Bonnicastle.' He tried editorial work, and started *The Bay State Weekly Courier,* which ran for six months. Subsequently he taught at Richmond, Va., and for 16 months was superintendent of public schools at Vicksburg, Miss. All these varied experiences gave him the knowledge of American life and appreciation of workday struggles which later made the value of his poems, essays and novels. In 1849–66 he was assistant editor of the Springfield *Republican,* and from 1851 also part owner of that journal. It was largely due to his influence that the *Republican* became so widely known and popular a journal. In it his 'Letters to Young People Married and Single: By Timothy Titcomb' first attracted readers by their vivacious style, moral sincerity and good common sense. Later, in book form (1858) they had a great and immediate success. In 1870 Dr. Holland was one of the founders and became editor of *Scribner's Monthly,* later the *Century Magazine* and the editorship of this periodical he retained till his death in 1881. Holland's novels 'Arthur Bonnicastle' (1873); 'Sevenoaks' (1876) and 'Nicholas Minturn' (1877), although showing his quick and sympathic observation and containing fine passages, have been less popular than his poems. The latter, in their constant appeal to the moral sense, and in their accurate portrayal of the homely and picturesque in New York life, found many admirers. Several of the short lyrics, with 'Bittersweet' (1858); 'Kathrina' (1868) and 'The Mistress of the Manse' (1871), came as messages of an American poet who understood and honored his own people. Consult the 'Life' by Plunkett (1894).

HOLLAND, Samuel, cartographer: b. England, 1717; d. 1801. He entered the army at an early age, served on the Continent and attained the rank of captain in 1765. He took part in the expedition against Louisbourg in 1758, and was Wolfe's engineer-in-chief at Quebec. In 1763 he was appointed surveyor-general of Quebec and director of surveys in British North America, and carried through many important surveys.

HOLLAND, Thomas Erskine, English jurist: b. Brighton, 17 July 1835. He studied at Oxford, was called to the bar in 1863, in 1874 became a reader in English law at Oxford, and shortly afterward professor of international law 1874–1910. His best-known work is his 'Elements of Jurisprudence' (1880; 11th ed., 1910), now a standard textbook in England and the United States. He wrote further 'An Essay on Composition Deeds' (1864); 'Essays on the Form of the Law' (1870); 'The European Concert in the Eastern Question' (1885); 'Studies in International Law' (1898), and subsequently works bearing on the laws of war and the rights and duties of neutrals.

HOLLAND, William J(acob), American zoölogist and palæontologist: b. Jamaica, W. I., 16 Aug. 1848. He was graduated from Amherst College in 1869, from the Princeton Theological Seminary in 1874, entered the ministry of the Presbyterian Church, and was a pastor at Pittsburgh, Pa., in 1874–91. In 1891–1901 he was chancellor of the Western University of Pennsylvania (Allegheny), and in 1897 was appointed director of the Carnegie Museum at Pittsburgh. In 1887 and 1889 he was naturalist of the United States eclipse expeditions to Japan and West Africa respectively. In 1907–09 he was president of the American Association of Museums. A recognized authority on museum administration and zoology, he wrote numerous scientific papers in learned publications, and 'The Butterfly Book' (1898); 'The Moth Book' (1903); 'To the River Platte and Back' (1913); 'The Butterfly Guide' (1915); also papers on the Tertiary fauna and Jurassic dinosaurs. He has received numerous decorations from foreign governments and honorary degrees from several universities.

HOLLAND, a popular designation for the kingdom of the Netherlands, derived from the provinces of North and South Holland, formerly constituting a feudal countship allied to the Holy Roman-German Empire, and from 1806–10 with other parts of the Netherlands, Hanover and Oldenburg, ruled by Louis Bonaparte as the kingdom of Holland. The region is the seat of the hardy and industrious Dutch race and of the Dutch language called by the natives *Nederduitsch,* a dialect of Low German phonology, with evolutionary periods of old, middle and modern, and an interesting historical and varied literature. See NETHERLANDS.

HOLLAND, Mich., city in Ottawa County, at the head of Black Lake, which is really an arm of Lake Michigan, and on the Père Marquette Railroad, about 80 miles west of Lansing and 25 miles southwest of Grand Rapids. It has direct communication by steamers with Chicago, Milwaukee and other lake ports. Holland was settled in 1847 by a Dutch colony, and many of its inhabitants are of Dutch descent. In 1867 it was chartered as a city. It is located in an agricultural region, once a lumber section. The manufactures are largely articles made of wood, but the beet-sugar industry is growing in importance. The chief manufacturing establishments are planing-mills, furniture, tub and basket factories, flour-mills, tanneries, woodworking machinery shops, pickling-plants, beet-sugar factory, grain elevators and creameries. The manufacture of launches is also an important industry of Holland. The trade is chiefly in the manufactures, and in grain and vegetables. The city owns and operates the electric-light plant and the waterworks. Holland is the seat of the Western Theological Seminary and of Hope College, both under the auspices of the Reformed Church in America. It has a number of fine public buildings and a free public library. The summer resorts on Black Lake add to the industrial wealth of the city. Pop. 11,650.

HOLLAND-LINEN, a fine and close fabric, so called from its first being manufactured in Holland; also a coarser linen fabric, unbleached or dyed brown, used for covering furniture, carpets, etc.

HOLLANDER, Jacob Harry, American economist: b. Baltimore, Md., 23 July 1871. He was educated in the Baltimore schools and graduated from Johns Hopkins University in 1891, receiving his Ph.D. degree in 1894. His ability as economist and financier was soon recognized, and he became associate professor of finance at Johns Hopkins. In 1897 he was appointed secretary of the Bimetallic Commission abroad and was chosen chairman of the Baltimore municipal lighting commission in 1900. In the same year the Secretary of War appointed him special commissioner to revise the laws relating to taxation in Puerto Rico, and while engaged in this service he was made treasurer of Puerto Rico by President McKinley. He devised and put into operation the present revenue system («Hollander Law») of the island. In 1904 he was special agent on taxation in the Indian Territory for the Department of the Interior. In 1905 he was sent by President Roosevelt to the Dominican Republic as special commissioner to investigate its public debt. Later, as special commissioner plenipotentiary to Santo Domingo (1905–06), and as financial adviser of the Dominican Republic (1908–10), he planned and carried out the readjustment of the public debt of that country. Since 1904 he has been professor of political economy in the Johns Hopkins University. He is the author of various books and monographs on economic and financial subjects, including 'The Cincinnati Southern Railway: A Study in Municipal Activity' (1894); 'The Financial History of Baltimore' (1899); 'Studies in State Taxation' (1900); 'Report on the Debt of Santo Domingo' (1906); 'David Ricardo: A Centenary Estimate' (1910). He edited the 'Letters of David Ricardo to J. R. McCulloch' (1895) and to 'Hutches Trower' (1899).

HOLLAR, Wenzel or Wenceslaus, vĕnt′zĕl or wĕn′sĕs-lâs hŏl′lär, Bohemian engraver: b. Prague, 13 July 1607; d. London, 28 March 1677. He accompanied the Earl of Arundel, English Ambassador to Germany, to London, who employed him to engrave some of the pictures of his collection. Among his numerous works, which are greatly esteemed for their delicate, firm and spirited execution, and which include some 2,740 plates, are the set of 28 plates, entitled, 'Ornatus Muliebris Anglicanus,' representing the dresses of Englishwomen of all ranks and conditions in full-length figures; Holbein's 'Dance of Death,' etc.

HOLLEBEN, hŏl′lā-bĕn, **Theodore von,** German diplomat: b. Stettin, Pomerania, 16 Sept. 1838; d. 1913. He was educated at the universities of Heidelberg, Berlin and Göttingen; became an officer in the Body-Guard Hussar Regiment; and took a distinguished part in the Franco-Prussian War. He entered the diplomatic service in 1872; was chargé-d'affaires at Peking, China, 1873–74, and at Tokio, Japan, in 1875; Minister at Buenos Aires in 1876–84; at Tokio 1885–89; and at Washington, D. C., 1892–93. In 1897 he became Ambassador Extraordinary and Plenipotentiary to the United States. At the command of Emperor William he, together with Secretary Hay, of the State Department, had charge of the arrangements for the official reception of the emperor's brother, Admiral Prince Henry, in February 1902. Failing health together with his inability to have President Roosevelt arbitrate the German-Venezuelan dispute caused his resignation, and in 1903 he was succeeded by Baron Speck von Sternberg. Consult Roosevelt, Theodore, ‹An Autobiography› (New York 1913).

HOLLEY, Alexander Lyman, American engineer: b. Lakeville, Conn., 20 July 1832; d. Brooklyn, N. Y., 29 Jan. 1882. He was graduated at Brown University in 1853, and became editor of *The Railroad Advocate* in 1856, changing its name to *The American Engineer*. He introduced into the United States in 1865 the Bessemer steel process, erecting the first Bessemer works in the country at Troy, N. Y. He was lecturer on the manufacture of iron and steel at Columbia University 1879–82. Holley secured many patents, the most important probably being that for the detached converter-shell, an improvement in the Bessemer process. He published with Z. Colburn: ‹Railway Economy: a Report on European Railways› (1858); ‹American and European Railway Practice› (1860); ‹A Treatise on Ordnance and Armor› (1865), etc. In 1890 a bronze bust of Holley was placed in Washington Square, New York, by the mechanical engineers of the United States and Europe.

HOLLEY, Marietta, American author, known by her pseudonym, «JOSIAH ALLEN'S WIFE»: b. near Adams, Jefferson County, N. Y. She began her literary career as a contributor to the *Christian Union*, the *Independent*, *Peterson's Magazine*, and other periodicals; and in 1873 published her first book, ‹My Opinions and Betsy Bobbet's,› which in a measure recalled the ‹Widow Bedott Papers› of F. M. Whitcher. This was followed by a series of works containing many touches of distinctive and genuine humor; ‹Samantha at the Centennial› (1876); ‹My Wayward Pardner› (1880); ‹Miss Richard's Boy› (1882); ‹Sweet Cicely› (1885); ‹Samantha at Saratoga› (1887); ‹Poems› (1887); ‹Samantha Among the Brethren› (1891), considered by many her best volume; ‹Samantha Amongst the Colored Folks› (1892); ‹Samantha at the World's Fair› (1893); ‹Samantha in Europe› (1895); ‹Around the World with Josiah Allen's Wife› (1899); ‹Samantha at the Saint Louis Exposition› (1904); ‹The Borrowed Automobile› (1906); ‹Samantha on Children's Rights› (1909); ‹Who was to Blame› (1910); ‹Samantha on Women's Rights› (1913); ‹Josiah Allen on Women's Rights› (1914). Her writings have had a large sale both at home and in foreign countries.

HOLLIDAYSBURG, hŏl'ĭ-dāz-bĕrg, Pa., borough, county-seat of Blair County, on the Juniata River, and the Pennsylvania Railroad; about 82 miles east of Pittsburgh and five miles south of Altoona. Rich coal-fields, iron-ore beds, ganister and limestone quarries are in the vicinity. The chief manufactures are foundry products, agricultural and mining implements, nails, silks, cars, furniture and classification yards. Hollidaysburg Female Seminary is a prosperous institution. The famous Ant Hill Woods are in the vicinity. The water-works are municipally owned. Pop. 3,734.

HOLLINS, George Nichols, American naval officer: b. Baltimore, Md., 20 Sept. 1799; d. there, 18 Jan. 1878. He entered the navy as midshipman in 1814, and while assigned to the *President*, Commander Decatur, was captured by the English and held prisoner at Bermuda until the conclusion of peace. He served also in the Algerine War of 1815, later assumed command of an East Indiaman, and in 1844 attained commander's rank. In 1855, on complaint of American residents who claimed they had been injured by the local officials, he bombarded Greytown, Nicaragua. At that time Nicaragua was under English protection, and the property and lives of English residents having been imperiled, international complications with Great Britain arose. Hollins was commissioned commodore in the Confederate navy at the outbreak of the Civil War, attacked the Federal blockading squadron at the passes of the Mississippi River, and was appointed flag-captain of the New Orleans station. He was superseded in 1862.

HOLLIS-MOSS BILL, better known as the Federal Farm Loan Act, and the Rural Credits Bill; a bill to provide capital for agricultural development, to create a standard form of investment in farm mortgages and other kindred purposes. It established the Federal Farm Loan Board, to be appointed by the President, and provided for the establishing of 12 Federal Land Banks by the Board in 12 equalized districts and for any needed number of National Farm Loan Associations to be made up of borrowers from the Land Banks. The bill was signed by President Wilson 17 July 1917. The full text of the bill may be found in Senate Document 444, 64th Congress, 1st Session.

HOLLISTER, Cal., town, county-seat of San Benito County, on the Southern Pacific Railroad about 80 miles southeast of San Francisco, and 35 miles east by south of Santa Cruz. It is situated in a rich agricultural region, noted for its fruit. The chief industrial interests of the town are connected with farming, dairying, fruit-growing and the shipment of grain and live-stock. Pop. 2,308.

HOLLOWAY, hŏl'ō-wā, **Laura Carter,** American author: b. Nashville, Tenn., 22 Aug. 1848. She was at one time editor of the *Home Library Magazine* of Chicago, Ill., was for 12 years associate editor of the Brooklyn *Daily Eagle*, and collaborated with Anton Seidl in the preparation of musical terms for the ‹Standard Dictionary.› She wrote ‹Ladies of the White House› (1870); ‹The Mothers of Great Men and Women› (1884); ‹The Home in Poetry› (1884); ‹Chinese Gordon; (1885); ‹The Buddhist Diet Book› (1887), and other volumes.

HOLLOWAY, Thomas, English patent medicine proprietor and philanthropist: b. Devonport, 22 Sept. 1800; d. Tittenhurst, 26 Dec. 1883. About 1837 he began to sell his well-known ointment, and soon afterward brought his pills to the notice of the public. He ultimately succeeded in amassing a very large fortune which he partly devoted to benevolent objects. The Royal Holloway College for Women, on the equipment and endowment of which he expended about $4,000,000, was opened on 30 June 1886. It contains a collection of pictures valued at $500,000. Near it is a sanatorium founded by him for the mentally afflicted of the lower middle class.

HOLLS, hōlz, **George Frederick William,** American lawyer and statesman: b. Zelienople, Pa., 1 July 1857; d. Yonkers, N. Y., 23 July 1903. He was graduated from Columbia in

1878, and from the law school there two years later. He was admitted to the bar and established a large law practice in New York city, becoming senior member of the firm of Holls, Wagner & Burghard; in his later life he visited Europe frequently and became widely known there, especially in Germany where he established a branch of his law firm. He was prominent in philanthropic work, being for years an officer of the Legal Aid Society and a director of the Charity Organization Society. He was also an active member of the Republican party, and much in demand as a campaign speaker, especially as he could address the Germans in their own language. In 1893 he was a delegate-at-large to the New York Constitutional Convention, where he was chairman of the committee on education, a member of the committee on cities and author of several amendments. His frequent visits abroad gave him a wide and intelligent interest in international questions, and at the time of The Hague Conference he was very influential in arousing interest and obtaining a large delegation from the United States. He was secretary of the American delegation at the Conference (1899), was the American member of the committee which drafted the arbitration treaty, and author of the clause on «Special Mediation.» He was afterward appointed a member of the permanent international court of arbitration. A few months before his death President Roosevelt asked him to umpire the adjustment of claims between Germany and England and Venezuela, but he declined. He has written ‘Sancta Sophia and Troitza’ (1888); ‘Compulsory Voting’ (1891); and ‘The Peace Conference at The Hague and Its Bearings on International Law and Policy’ (1900).

HOLLWECK, Josef, German Catholic clergyman and jurist: b. Pfaffenhofen, Bavaria, 16 Jan. 1854. He received his education at the Royal Gymnasia of Amberg and Eichstätt, at the Episcopal Lyceum, Eichstätt, and at the University of Freiburg. In 1879 he was ordained to the priesthood and for the following six years was engaged in parish work in his native diocese of Eichstätt. In 1885–90 he was assistant director of the Seminary of Eichstätt, and since 1890 he served as professor of canon law and catechetics of the Episcopal Lyceum there. In 1910 he was made a domestic prelate of His Holiness Pius X. In 1904 he assisted in the work of the new codification of the canon law and was repeatedly called to Rome to assist the Commission of Codification in its work. He has published ‘Das kirchliche Bücherverbot’ (1897); ‘Die kirchlichen Strafgesetze’ (1899); ‘Die Civilehe des bürgerlichen Gesetzbuches im Lichte des kanonischen Eherechts’ (1900); ‘Das Testament des Geistlichen’ (1901); ‘Lehrbuch des Kirchenrechts’ (1905); ‘Über das Alter der Erstkommunicanten’ (1910), and contributions to ‘The Catholic Encyclopedia,’ and various periodicals.

HOLLY. See Ilex.

HOLLY SPRINGS, Miss., a point on the Mississippi Central Railroad, about 40 miles southeast of Memphis and about 25 miles south of Grand Junction, on the Memphis and Charleston Railroad, and an important strategical point. After the battle of Iuka, 19 Sept. 1862, and the Confederate defeat at Corinth, 3-4 Oct. 1862, the Confederates fell back to Holly Springs. Early in November General Grant had concentrated an army of 30,000 men in the vicinity of Grand Junction to make a movement along the line of the Mississippi Central Railroad in the direction of the rear of Vicksburg. On 8 November General McPherson, with 10,000 infantry and 1,500 cavalry, advanced from Grand Junction southward and pushed the Confederates under General Pemberton back to Holly Springs. The main body of Grant's army moved forward, and Pemberton, abandoning Holly Springs, fell back to Grenada, Grant following to Oxford, 30 miles beyond Holly Springs. There he arrived 5 December, and arranged with General Sherman a combined movement on Vicksburg. Grant was to move directly south on the line of the railroad and take the place in rear; Sherman to move a force from Memphis, accompanied by a gunboat fleet, to descend the Mississippi and attack in front. A depot of supplies was established at Holly Springs, guarded by Colonel Murphy, with two regiments of Wisconsin infantry and a regiment of Illinois cavalry, and Grant was about to move forward from Oxford, when Gen. Earl Van Dorn, at the head of 3,500 cavalry, dashed into Holly Springs at daylight, 20 December, and attacked Murphy, who had been warned of the impending danger on the 19th, but neglected to take the necessary precautions and was surprised. He made a feeble resistance and surrendered his infantry; the cavalry cut its way out and escaped with the loss of only seven men. Van Dorn took about 1,500 prisoners, destroyed stores to the value of $1,500,000, and left town in the afternoon. This disaster, in connection with Forrest's raid into West Tennessee, which destroyed Grant's communication, forced him to abandon his movement on Vicksburg and fall back to Grand Junction, leaving Pemberton at liberty to concentrate his forces at Vicksburg against Sherman. Sherman was informed of Grant's failure, but the information reached him after his bloody repulse at Chickasaw Bluff, 27-28 Dec. 1862. Consult ‘Official Records’ (Vol. XVII); Greene, ‘The Mississippi.’

HOLLYHOCK, a tall and rather coarse flowering plant (*Althæa rosea*) of the mallow family, said to be a native of China, but now cultivated all over the world as an ornament of gardens. It rises in a single leafy stalk, sometimes to the height of six or eight feet, studded with large single or double flowers, in varieties from white to yellow, scarlet, and purple. Although rather difficult to start and slow of growth, it remains a hardy and easily nurtured perennial of highly effective beauty when suitably placed.

HOLM, Frits (Vilhelm), Danish explorer, journalist and lecturer: b. Charlottenlund, Denmark, 23 July 1881. He was educated at private and government Latin schools. He passed a preliminary examination at the Copenhagen University and received, 1895–1900, an officer's education in the Royal Danish navy, visiting many countries on men-o'-war. Having seen the Paris Exposition of 1900, he went to the Far East and worked in Shanghai and Hankow in journalistic and commercial positions 1901–03, eventually accepting the posts of manager and editorial secretary of *The Japan Daily Ad-*

vertiser in Yokohoma. In May 1904, during the Russo-Japanese War, he left Japan and returned to Denmark via the United States, where he visited the Saint Louis World's Fair as special correspondent, completing in nearly four years his first circumnavigation. From September 1905 till February 1907, he worked with the Potentia Press Organization in London under the Earl of Kintore and Sir William Ramsey, frequently visiting the Continent; and in July 1906 he represented The Associated Press at the Interparliamentary Peace Conference in the House of Lords. He is a life-member of the Royal Yacht Club (Copenhagen), of the Imperial Red Cross societies of Russia and Japan (war medals) and of the Kihin Kai (Tokio); a member of the Royal Asiatic Society (London) and other scientific institutions and an officier of the Venezuelan Order of the Libertador. He is the author of numerous articles on Far Eastern and other subjects, and he holds a royal license as sworn interpreter, commanding English, French, German and the three Scandinavian languages, besides knowing something of the romance tongues and Chinese. At the age of 25 he obtained the capital for a scientific expedition into the interior of China. The result of the Holm-Nestorian expedition to Sian-Fu 1907–08, which covered by caravan and water more than 2,500 miles through little-known regions, was the bringing to civilization of a two-ton, 10 feet high monolithic replica of the famous Nestorian Monument of A.D. 781 — since July 1908 as a loan in the Metropolitan Museum, New York. 'The Nestorian Monument' (Chicago 1909) tells about the tablet and the expedition, through which he completed his second circumnavigation. He has lectured, in English and French, in 15 universities and learned institutions in the United States, Canada and Mexico on his exploration work, about which hundreds of illustrated newspaper and magazine articles have appeared.

HOLM, Saxe, a pseudonym affixed to a collection of 'Stories' (1st series 1874; 2d 1878), originally published in *Scribner's Monthly* and generally believed to be by Helen Hunt Jackson (q.v.).

HOLMAN, Frederick Van Voorhies, American lawyer: b. Baker's Bay, Pacific County, Wash. (then in Oregon), 29 Aug. 1852. He was educated in public and private schools, at the Portland Academy and the University of California. In 1879 he was admitted to the Oregon bar and has since practised at Portland, specializing in corporation, real property, and probate law. He was general counsel and director of the Portland Railway, Light and Power Company, counsel for and director of the Oregon Power Company and other corporations. Since 1903 he has been a regent of the University of Oregon. He has done much for the growth and development of Portland, Ore., and originated and caused to be adopted the name of "The Rose City" for Portland. In 1904–08 he was Democratic National Committeeman for Oregon, and served as delegate to the Democratic National Conventions of 1892, 1904 and 1912. He is a member of the bars of the United States and the Washington State Supreme Courts and in 1909–10 was president of the Oregon Pioneer Association. He published 'Life of Dr. John McLaughlin, Father of Oregon' (1907), also historical articles, pamphlets, contributions to various magazines.

HOLMAN, hōl'man, **William Steele,** American politician: b. Veraestau, Dearborn County, Ind., 6 Sept. 1822; d. Washington, D. C., 22 April 1897. He studied at Franklin College (Ind.), was admitted to the bar. and began practice at Aurora, Ind. In 1847–49 he was prosecuting attorney, in 1850 a member of the State Constitutional Convention, in 1851–52. of the State legislature. He was a judge of the Court of Common Pleas in 1852–56, in 1856 was elected as a Democratic representative to Congress, where with the exception of eight years he served until his death. His vigilance in opposing unnecessary appropriations and doubtful measures obtained for him the sobriquets of "The Watchdog of the Treasury," and "The Great Objector."

HOLMAN-HUNT, William. See HUNT, WILLIAM HOLMAN.

HOLMES, hōmz, **Abiel,** American Unitarian clergyman and annalist: b. Woodstock, Conn., 24 Dec. 1763; d. Cambridge, Mass., 4 June 1837. He was graduated at Yale College in 1783, and became subsequently a tutor in the college, pursuing at the same time his theological studies. In 1785 he was settled over a parish at Midway, Ga., where he remained till 1791. Returning north he became pastor of the first parish in Cambridge, and continued to fill the office till 26 Sept. 1832. Besides publishing a 'Life of President Stiles' in 1798, he was the author also of 'Annals of America' (1805), which gave him a high reputation for care and accuracy. It was republished in England in 1813. He contributed frequently to the collections of the Massachusetts Historical Society, in Vol. XXVII of which will be found a complete list of his publications.

HOLMÈS, ō-mĕs', **Augusta Mary Anne,** French composer: b. Paris, 1847; d. there, January 1903. She studied composition with Lambert, Klose and César Franck, and began her career as a pianist. Her first work of magnitude was a setting of the psalm 'In Exitu,' sung for the first time in 1873. She later wrote considerable music, including 100 songs, characterized by much grace of expression. In the larger forms her compositions include the well-known symphony 'Hero et Léandre'; three other symphonies, 'Lutèce,' which in 1879 won third prize in an open competition directed by the Paris municipality, 'Les Argonautes' and 'Irlande'; the symphonic poems, 'Les Sept Ivresses,' 'Roland,' 'Pologne,' 'Au Pays Bleu'; an ode of triumph, 'Patrie'; a four-act lyric opera, 'Le Montagne Noire' (Grand Opera 1895), and an allegorical cantata, 'La Vision de la Reine.'

HOLMES, E(lias) Burton, American traveler and lecturer: b. Chicago, 8 Jan. 1870. After a secondary education at Chicago he traveled in all the countries of continental Europe, as well as in Japan, Algeria, Tunis, Morocco, Corsica, Greece and Thessaly. Hawaiian Islands, the Yellowstone Park, the Grand Cañon of the Colorado, the Philippines and China. About 1890 he became known as a platform lecturer, giving in popular form the results of his observations. He has traveled and lectured in all countries except Australia, New

Zealand and South Africa. He has published 'The Burton Holmes Travelogues' (12 vols.).

HOLMES, Charles John, English landscape painter: b. Stratton, Cornwall, 11 Nov. 1868. He was educated at Saint Edmund's Canterbury, at Eton and at Oxford, where he was classical scholar in 1887. In 1896–1903 he was publisher and manager of the Vale Press; in 1903–09 was editor of the *Burlington Magazine,* and from 1904 to 1910 was Slade professor of fine art at Oxford. His works are in the Art Galleries of Manchester and Johannesburg; in the Ashmolean Museum, Oxford, and the British Museum. In 1909 Mr. Holmes was made keeper and secretary of the National Portrait Gallery and in 1916 was appointed director of the National Gallery, to succeed Sir Charles Holroyd. He has published 'Hokusai' (1898); 'Constable' (1901); 'Pictures and Picture Collecting' (1902); 'Constable and his Influence on Landscape Painting' (1902); 'Notes on the Science of Picture-Making' (1909); 'Notes on the Art of Rembrandt' (1911); 'The Tarn and the Lake' (1913).

HOLMES, George, Canadian bishop: b. Westmoreland, England, 1860. He was educated at the Church (Anglican) Missionary College, Islington, and was ordained to the priesthood in 1888. He was consecrated bishop of Moosonee 25 Jan. 1905, and translated to the diocese of Saskatchewan 1909.

HOLMES, Mary Jane Hawes, American novelist: b. Brookfield, Mass.; d. Brockport, N. Y., 7 Oct. 1907. She was married to Daniel Holmes, a lawyer of Brockport, N. Y. She published many volumes of domestic fiction which have had an extraordinarily wide circulation but in which the literary element is slight. Among her novels are 'Tempest and Sunshine' (1854) (perhaps the best known of them all); 'Lena Rivers' (1856); 'Marian Gray' (1863); 'Milbank' (1871); 'Queenie Hetherton' (1883).

HOLMES, Nathaniel, American jurist and Shakespearean scholar: b. Peterboro, N. H., 2 Jan. 1815; d. Cambridge, Mass., 26 Feb. 1901. He was graduated from Harvard in 1837 and after admission to the bar in 1839 began to practise in Saint Louis. He was judge of the Supreme Court of Missouri 1865–69, and Royall professor of law at Harvard 1868–72. He retired from his profession in 1883 and henceforth devoted himself to study and authorship. He was a strong believer in the Baconian theory of the origin of Shakespeare's plays, which he defends in his work, 'The Authorship of Shakespeare' (1866). In 1888 he published 'Realistic Idealism in Philosophy Itself.'

HOLMES, Oliver Wendell, American poet, essayist and physician: b. Cambridge, Mass., 29 Aug. 1809; d. Boston, Mass., 8 Oct. 1894. He was the son of Rev. Abiel Holmes (q.v.), minister of the first parish in Cambridge, and on the maternal side was a descendant of Anne Bradstreet (q.v.) and related to the orator, Wendell Phillips, the poet, Richard Henry Dana, and the theologian, Dr. Channing. He was educated at Phillips Academy, Andover, and at Harvard, and was graduated from the latter in 1829 in a class which contained several who afterward became famous. In the next year he became well known through his poem 'Old Ironsides,' first published in the Boston *Advertiser,* and which prevented the breaking up of the famous frigate *Constitution.* He spent a year in the Harvard Law School but soon turned his attention to medicine and after studying in Paris three years returned to America where he received his degree of M.D. in 1836, the same year in which his first volume of poems appeared. He was professor of anatomy and physiology at Dartmouth College 1839–40. He married in the last-named year, and established a practice in Boston, becoming in 1847 professor of anatomy and physiology in the Harvard Medical School, a post which he resigned in 1882, when he was at once made professor emeritus. In 1849, and for several succeeding years, he made his summer home at Pittsfield, Mass., the scene of his novel 'Elsie Venner.' He was one of the first contributors to the *Atlantic Monthly* when it was established in 1857, the opening chapter of his 'Autocrat of the Breakfast Table' appearing in the first issue. It is this work, which has found innumerable readers both at home and abroad, by which he will be longest remembered. These brilliant conversational papers were followed in 1859 by a similar series, 'The Professor at the Breakfast Table,' and these in 1872, by 'The Poet at the Breakfast Table.' Many of his best poems were scattered through these volumes. In 1861 appeared his novel 'Elsie Venner: a Romance of Destiny,' and in 1868 'The Guardian Angel,' a less striking fiction than its predecessor, but like that exhibiting a remarkable series of studies of character. 'A Mortal Antipathy' (1885) was his only other essay in fiction. His volumes of verse, 'Urania' (1846) and 'Astrea' (1850), had made him well known as a poet ere he appeared before the public as the kindly breakfast table autocrat, and he continued to write poetry at frequent intervals for the rest of his life. He was especially happy as the poet of occasions, but much of his verse, witty and sparkling as it is, is ephemeral from its very nature and not destined to endure. In such serious poems, however, as 'The Chambered Nautilus'; 'The Voiceless'; 'The Last Leaf'; 'The Iron Gate'; and one or two hymns, he takes high rank among the poets of his time, while such poems as 'The One Hoss Shay'; 'Evening, By a Tailor,' and 'Parson Turrell's Legacy,' to name no others, are inimitable examples of humorous verse. His later collections of poems comprise 'Songs in Many Keys' (1861); 'Songs of Many Seasons' (1875); 'The Iron Gate' (1880); and 'Before the Curfew' (1887). As a physician and medical lecturer he was very successful, and among his purely professional works may be named 'Lectures on Homeopathy and Its Kindred Delusions' (1842); 'Currents and Counter Currents in Medical Science' (1861); 'Border Lines in some Provinces of Medical Science' (1862); 'Medical Essays,' a reissue of some of his earlier work (1883). Still other volumes by Dr. Holmes are 'Soundings from the Atlantic' (1864), a series of essays originally contributed to the *Atlantic Monthly,* where the bulk of his writing first appeared; 'Mechanism in Thought and Morals' (1871); lives of 'John Lothrop Motley' (1879); and 'Ralph Waldo Emerson' (1884); 'Our Hundred Days in Europe' (1888), a sprightly record of a short visit to England in 1886, on which occasion honorary degrees were conferred upon him by the uni-

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versities of Cambridge, Oxford and Edinburgh; and 'Over the Teacups' (1891). His 70th birthday was celebrated by a breakfast given in his honor by the publishers of the *Atlantic Monthly*, and on this occasion the poet read his poem 'The Iron Gate,' which many persons have considered even finer than 'The Chambered Nautilus' which Holmes himself preferred to any other verses of his. At its best Holmes's prose style is thoroughly admirable, characterized as it is by an unerring sense of the value of words and their fitness for conveying a desired impression, and illumined by the interfused play of a delicate fancy and the most sparkling humor. Next to 'The Autocrat' must be ranked 'The Guardian Angel' among his prose works, the same kindly tolerant spirit being dominant in both, and the same shrewd, wholesome perception of character. In much of his earlier poetry, excepting in his lyrics, Holmes uses the formal 10-syllabled iambic pentameter of the 18th century, but in his hands the measure seems at times more flexible than when used by Pope and his school, and it is at all events relieved from solemnity by his ever-present humor. 'Urania' is the best known of his earlier efforts in this manner, and 'The Schoolboy' (1878) his most notable later one, this latter having been written for the centennial anniversary of Phillips Academy at Andover. Holmes's special characteristic was kindliness, which found its expression as well in his verse as in his prose, and in his ordinary living. He could be keenly satirical on occasion but he never became in the least cynical. Of slight physique and charming personality, Holmes endeared himself to all his acquaintances, while his literary fame is secure beside that of Longfellow, Lowell and Whittier. Holmes's gentle, tolerant writing did not a little toward softening the asperities of controversy and liberalizing unconsciously the heart of Puritan New England. Consult Morse, 'Life and Letters of Oliver Wendell Holmes' (1896); and lives by Kennedy (1883); E. E. Brown (1884); Howell, 'Literary Friends and Acquaintances' (1899). See ELSIE VENNER.

HOLMES, Oliver Wendell, Jr., American jurist: b. Boston, 8 March 1841. He was graduated from Harvard in 1861, and in the same year entered the army as lieutenant of the 20th Massachusetts regiment. He was wounded at the battles of Ball's Bluff, Antietam and the second battle of Fredericksburg and was mustered out of the army in 1864 with the rank of brevet lieutenant-colonel. He then studied at the Harvard Law School and was admitted to the bar in 1866 beginning his practice in Boston. He was editor of the *American Law Review* (1870–73); became professor at the Harvard Law School in 1882 and in the same year justice in the Massachusetts Supreme Court; in 1899 he was appointed chief justice of the same court. His decisions in this position gave him wide fame among lawyers and were characterized by originality and literary finish. In several cases his decisions were in favor of organized labor; his position being that workingmen had a right to combine and to "support their interests by arguments, persuasion, and the bestowal or refusal of those advantages which they otherwise lawfully control, so long as they do no violence or threaten no violence." In August 1902, he was appointed a member of the United States Supreme Court. He has published 'The Common Law' (1881), lectures delivered before the Lowell Institute, and an important contribution to legal history; and a collection of speeches (1900); a second collection (1913); he also edited the 12th edition of Kent's 'Commentaries' (1873).

HOLMES, Theophilus Hunter, American soldier: b. Sampson County, N. C., 1804; d. near Fayetteville, N. C., 21 June 1880. He was graduated from the United States Military Academy in 1829, served in the Florida war, the occupation of Texas and the Mexican War, and at the beginning of the Civil War was major and superintendent of the general recruiting service. On 22 April 1861, he resigned his commission in the United States army, forthwith was appointed brigadier-general in the Confederate forces and organized several North Carolina regiments. He was in command at Aquia Creek, and, promoted major-general, was in command of the trans-Mississippi department from September 1862 to March 1863, was commissioned lieutenant-general, and 3 July 1863 lost heavily in an unsuccessful attack on Helena, Ark.

HOLMES, William Henry, American anthropologist and archæologist: b. near Cadiz, Ohio, 1 Dec. 1846. He was graduated at McNeely Normal College in 1870, and was assistant on the United States Geological Survey 1872–80. During that period he accompanied Dr. F. V. Hayden's explorations in the Rocky Mountain region and superintended the survey of the San Juan territory until the reorganization of the survey in 1880, when he was appointed geologist in charge of the department of illustrations. He had charge of the archæological explorations of the Bureau of Ethnology in 1889–93, in 1894–98 was professor of archæologic geology at the University of Chicago, from 1898 to 1902 and again after 1910 was curator of the United States National Museum, and was chief of the Bureau of American Ethnology from 1902 to 1909. He was president of the American Anthropological Association, and of the National Society of Fine Arts in 1909. In 1905 he became a member of the National Academy of Sciences. He edited geological publications, including Hayden's 'Atlas of Colorado,' and the 11th and 12th 'Reports of the Geological Survey,' and has published 'Archæological Studies among the Ancient Cities of Mexico' (1895); 'Stone Implements of the Potomac-Chesapeake Tidewater Province' (1897); and papers on aboriginal American art.

HOLOCAINE. See COCAINE.

HOLOCEPHALI, hŏl-ō-sĕf'ạ-lī, or **CHIMÆROIDEA,** a group of small shark-like fishes of bizarre appearance occurring in the deeper portions of all colder seas, including in all about seven species, five in American waters. They have a cartilaginous skeleton, are of no value as food and are known to fishermen as rat-fish and elephant-fish (q.v.). The name Chimæra, given to one genus, emphasizes the strange appearance of these fishes. See ICHTHYOLOGY.

HOLOPHYTES, hō'lō-fīts. See FUNGI.

HOLOSTEI, hō-lŏs'tẹ-ī, a group of fishes, the bony ganoids, largely fossil, represented by the garpikes. See ICHTHYOLOGY.

HOLOTHURIA, hŏl-ō-thū'rĭ-a, echinoderms (q.v.) of the class *Holothuroidea,* popularly called "seacucumbers," from their resemblance in shape and rough skin to that vegetable, in which the body is long, cylindrical, somewhat wormlike, less obviously radiated than other echinoderms with a thick muscular body-wall of longitudinal and transverse muscles. The skin is usually thick, tough and imbedded in it are in certain forms calcareous plates, wheels and anchors. The mouth is surrounded with a circle of 10 branched tentacles, adapted both for respiration and for seizing the food, which consists mainly of foraminifera. The intestine is suspended by mesenteries, is very long and slender, thus in *Thyone briareus,* which lives in mud and sand on the coast south of Cape Cod, the intestine in an individual three or four inches long is nearly seven feet in length; it opens at the end of the body, and connects with the "respiratory tree," by which the water is introduced into the interior of the body. Also opening into the cloaca or terminal part of the intestine are the so-called Cuvierian organs, secreting slime on their peritoneal surface. The holothurians possess the power of eviscerating themselves through the cloaca, and these organs then serve as means of snaring an enemy. The destroyed viscera are then regenerated. Unlike other echinoderms the so-called madreporic body is internal. Holothurians move by tubes or ambulacra which are filled with water, and when distended act as suckers to drag the animal over the bottom. These suckers are either arranged in five rows or with three rows on the ventral surface, and two above, the latter serving the function of sense-organs, or they are scattered irregularly over the surface of the body, while in *Caudina arenata* of the New England coast there are no suckers. A tendency to bilateral symmetry is seen in a form *Psolus,* which has a creeping disk and three rows of suckers on the flattened disc-like under side. The nervous system resembles that of the sea-urchins, with its five radial nerve cords prolonged into the radia, and terminating in sensory patches of epithelium. Pigment spots, however, are lacking. There is a cœlomic nervous system. The blood system consists of a ring around the œsophagus, with branches along the stone canal and above and below the gut. The genital organs are located on the left of the dorsal mesentery, and the genital duct opens below and a little behind the feelers.

The holothurians undergo a metamorphosis, somewhat like that of the starfish; but the transparent larva called "auricularia" is barrel-shaped; what corresponds to the hoops of the barrel being bands of cilia, while the ear-like projections in certain forms give it the name auricularia. Before the larva is fully grown, the body of the young holothurian begins to bud out from near the side of the larval stomach, the calcareous cross-like plates are deposited, and the tentacles begin to grow out. Finally after the larval body is absorbed the young holothurian sinks to the bottom. The degree of metamorphosis is less marked than in other echinoderms, while in two forms development is direct, the young growing in a marsupium or broodpouch. A form (*Cladodactyla crocea*) living in the south seas at the Falkland Islands, carries its young in a sort of nursery where they are densely packed in two continuous fringes adhering to the dorsal tubes. Holothurians are remarkable from the fact that when captured they eject their intestine, a new one in time being regenerated. The large forms lying about on the coral reefs are known to harbor a small slender fish (*Fierasifer*) which lodges in their cloaca or in the branchial tree. Many of the species are very large, being nearly two feet in length. A common species on the Florida keys and reefs is *Holothuria floridana;* it lives in water only a few inches deep and can be picked up in large numbers; it is fully 15 inches in length and lives on foraminifera. It has been collected, dried and a shipload exported to China, but the trepang or beche-de-mer of commerce is either of two species (*H. edulis,* and *H. tremula*) inhabiting the Pacific Ocean. (See Trepang). A California species is also dried and exported by the local Chinese.

The class of *Holothuroidea* is divided by Ludwig into two orders: (1) *Actinopoda,* with radial canals, represented by *Holothuria, Cucumaria, Thyone, Psolus,* etc.; and (2) *Paractinopoda,* without radial canals, of which *Synapta* is an example, the common form living in sand at low water on the New England coast being *Leptosynapta girardii.* MacBride, on the other hand, divides the holothurians into six orders. A few forms inhabit great depths. Remains of holothurians have been found fossil; certain calcareous plates attributed to them occurring in the Carboniferous, Lias, Jura and Cretaceous strata. Minute calcareous bodies referable to *Synapta,* etc., have been detected in the Paris Eocene limestones. Consult 'Cambridge Natural History' (Vol. I, London 1909).

HOLST, hōlst, **Hermann Eduard von,** German-American historian: b. Fellin, Livonia, Russia, 19 June 1841; d. Freiburg, Germany, 20 Jan. 1904. He studied history in Dorpat and Heidelberg and in 1865 traveled through France, Italy, etc. His writings were looked upon with suspicion by the Russian authorities and his further stay in that country becoming unsafe, he removed to the United States in 1866. Here he became American correspondent of the *Kölnische Zeitung,* and sub-editor of the 'Deutsch-amerikanischer Conversations-Lexicon.' In 1872 he was appointed extraordinary professor of history in the University of Strassburg and in 1874 ordinary professor at Freiburg-im-Breisgau. In 1876 he undertook, with means furnished by the Baden government, a journey to London for the purpose of study and in 1878–79 a similar journey to North America at the expense of the Prussian Academy of Science. In 1892 he accepted an appointment in the University of Chicago. He has published 'Constitutional and Political History of the United States' (1873); 'The French Revolution Tested by Mirabeau's Career' (1894), etc.

HOLSTEIN, hōl'stīn, Germany, a former duchy of Denmark, and member of the Germanic Confederation, since 1866 united to Schleswig-Holstein (q.v.), Prussia.

HOLSTEIN CATTLE. See Cattle.

HOLSTON, hōl'stŏn, a river which rises in the southwestern part of Virginia, flows south and southwest into Tennessee and unites with the French Broad River about five miles east of Knoxville. The Holston and the French Broad are the head-streams of the Tennessee River. The course of the Holston is through a mountainous country, noted for its beautiful scenery. It has as tributaries many small mountain streams. It is navigable for about 50 miles for vessels of light draught. Its length is about 200 miles.

HOLT, Joseph, American jurist: b. Breckinridge County, Ky., 6 Jan. 1807; d. Washington, D. C., 1 Aug. 1894. He began legal practice at Elizabethtown in 1828, and in 1857 was appointed commissioner of patents. In 1859 he became Postmaster-General and in 1860 Secretary of War. He was made by Lincoln a judge-advocate-general of the army, with colonel's rank, was promoted brigadier, brevetted major-general for distinguished service in the Bureau of Military Justice and was retired in 1875. With the exception of Cass, he was the only member of Buchanan's Cabinet that was not a Confederate sympathizer. Among the courts over which he presided were those before which Fitz-John Porter and Lincoln's assassins were tried.

HOLTON, Kan., city, county-seat of Jackson County, on the Missouri Pacific, the Chicago, Rock Island and Pacific and the Union Pacific railroads, about 28 miles north of Topeka and 30 miles west of Atchison. It was settled in 1859 and received its charter in 1870, and adopted the commission form of government in 1912. It is situated in a section noted for good farms. The chief manufactures are flour, wagons, cigars, bottles, creamery products and planed lumber. There are also a quilting factory, a fruit nursery and a rat-trap factory. Its trade is chiefly in wheat, corn, hay, live-stock and local manufactured products. It is the seat of Campbell College. The waterworks and electric-light plant are the property of the city. Pop. 2,842.

HÖLTY, Ludwig Heinrich Christoph, lood'vĭg hīn'rĭн krēs'tŏf hėl'tĭ, German lyric poet: b. Mariensee, near Hanover, 21 Dec. 1748; d. Hanover, 1 Sept. 1776. In 1769 he went to Göttingen to study theology. Here, falling in with Bürger, Voss, the Stolbergs and other poets of kindred tastes, he became one of the founders of the Göttingen «Hainbund.» This league of young enthusiasts was aflame for Klopstock, then considered the greatest German poet for patriotism and for friendship, detested Wieland's sensual poems and his Frenchified manner, read the classics together and wrote poetry in friendly emulation. Hölty's poems reveal a lovable personality. The strain of sentimentality that runs through all his work is not affectation, as it was with so many of the younger poets of that age in which Rousseau had made sentimentality fashionable, but the true expression of his nature. His range was small; but within his limits his work was excellent, and many of his songs have become the common property of the people. Consult Voigts, 'Hölty, ein Roman' (1844); Reute, 'Hölty, Sein Leben und Dichten' (1883).

HOLUB, ho'loob, **Emil,** Austrian explorer: b. Holics, Bohemia, 7 Oct. 1847; d. Vienna, 21 Feb. 1902. At 25 he went to South Africa, where he practised in Kimberley and elsewhere as a physician. Later he became engaged in African exploration and in recognition of his services as an explorer received from the Austrian emperor the Order of the Iron Crown. He published 'Beiträge zur Ornithologie Südafrikas'; 'Sieben Jahre in Südafrika' (1881); 'The Colonization of Africa'; and 'From Cape Town to the Maskukulumbe.'

HOLY ALLIANCE, an international league proposed by Alexander I, emperor of Russia, 26 Sept. 1815, after the defeat of Napoleon at Waterloo had cleared the way for the execution of his desire of establishing a settled peace in Europe. Alexander, Francis of Austria and Frederick William III of Prussia, signed with their own hands, and without the countersign of a minister, the act establishing this alliance, which is said to have been sent to the two latter in the handwriting of the first. It was not wholly published till 2 Feb. 1816, when the text was given in full in the Frankfort *Journal*. It consisted of a declaration, that, in accordance with the precepts of the gospel of Jesus Christ, the principles of justice, charity and peace should be the basis of their internal administration, and of their international relations, and that the happiness and religious welfare of their subjects should be their great object. Their majesties considering themselves as delegated by Providence to govern three branches of the same family, namely, Austria, Russia and Prussia, and regarding their peoples as having no other sovereign than Him to whom alone all power belongs of right, declared that they would lend one another on every occasion and in every place assistance, aid and support. Its real aim was to maintain the power and influence of the existing dynasties. It was also stipulated that the three sovereigns should invite others to become members of the Holy Alliance. In Russia and Germany its principles were not discussed except in a spirit of eulogy, but they were uncompromisingly condemned in Britain by many of her foremost statesmen. On 4 Feb. 1823 both Lansdowne and Brougham openly condemned its doctrines in their places in Parliament. Sir James Mackintosh said of the doctrine of legitimacy, in the sense in which it was used by the Holy Alliance, «Sophistry lent her colors to the most extravagant pretensions of tyranny.» The events of 1848 broke up the Holy Alliance. It had previously lost much of its authority from the death of Alexander, and the French Revolution of 1830. By a special article of the treaty the members of the Bonaparte family were declared incapable of occupying any European throne. It was in pursuance of the terms of the Alliance that revolutionary uprisings in Naples, Piedmont and Spain were suppressed by the armed forces of its members in the early part of the 19th century. The threat of the Allies to intervene in the war between Spain and her South American colonies with a view to restoring those colonies to Spain from whom they had separated and declared their independence was the chief cause which led President Monroe in 1823 to send his famous message to Congress proclaiming what later came to be known as the Monroe Doctrine (q.v.).

For the text of the Treaty of the Holy Alliance with a full discussion of its nature and purpose and the historical events which produced it and to which it led, Consult Snow, 'Topics in American Diplomacy' (pp. 237ff. Boston 1894).

HOLY CROSS, College of the, an institution in charge of the Fathers of the Society of Jesus, situated at Worcester, Mass. The school was founded in 1843. The college grants the usual degrees given by classical and scientific institutions. It is self-supporting; up to 1916 it had received no State aid nor any endowments. It has established six fellowships. In 1916 there were connected with the school 30 professors and instructors and nearly 600 students. The library contained about 40,000 volumes.

HOLY CROSS, Mount of the, a peak of the Rocky Mountains, in Eagle County, in the State of Colorado. The peak is about 75 miles southwest of Denver, and 20 miles north by west of Leadville. It is 14,170 feet high.

HOLY DAY, a day set apart in the Catholic Church for the commemoration of some saint or mystery. It is called "of obligation" when attendance at Mass and abstention from servile works are prescribed.

HOLY GHOST, in Christian theology, the third person of the Trinity. The doctrine of the Holy Spirit is a distinctively Christian one, but foreshadowings of it are believed by some to be found in the Old Testament. Thus the Spirit of Jehovah is the active divine principle in nature (Gen. i, 2; Ps. civ) and the generator of the higher energies of the human soul (1 Samuel xvi, 13) especially of the prophetic faculty, while the prophets look forward to the Messianic age as the special time for the full manifestation of the Spirit. But it is in the New Testament that we find the bases of the doctrine of the Spirit's personality. The early Christians saw its work in the form of extraordinary gifts, as at the day of Pentecost (Acts ii, 4; x, 44) which inaugurated the new dispensation; for Saint Paul it is the principle of the divine life in the community (Rom. viii, 10), the begetter of all the spiritual graces (Gal. v, 22). But the Spirit's proper personality is most clearly found in the Gospel of John (xiv, 16–26), though it seems to be already implied in Matthew (xxviii, 19). Yet the early Church did not forthwith attain to a complete doctrine; nor was it, in fact, until after the essential divinity of Jesus had received full ecclesiastical sanction that the personality of the Spirit was explicitly recognized, and the doctrine of the Trinity formulated. Rationalistic writers have usually endeavored to reduce the being of the Spirit to the presence of the moral faculty in man, but this is to put the matter lower than the facts warrant. It is better to regard the Spirit as the agency which, proceeding from the Father and the Son, dwells in the church as the witness and power of the life therein. If we realize this energy as implying the presence of God Himself, the divinity and personality would seem to become intelligible and credible. (For the question as to whether the Spirit proceeds from the Father alone, or from the Father and the Son, which ultimately brought about the separation of the Greek and Roman churches, see GREEK CHURCH; TRINITY). Consult Arnal, J., 'La notion de l'Esprit' (Paris 1908–11); Swete, H. B., 'The Holy Spirit in the New Testament' (New York 1909); De Regnon, T., 'Etudes de théologie positive sur la Sainte Trinité' (2 vols., Paris 1892); Smeaton, 'Doctrine of the Holy Spirit' (Edinburgh 1882).

HOLY GHOST, Order of, a former order of Hospitalers, founded by Guy, son of William, Count of Montpellier, in the 12th century for the relief of the poor, the infirm and foundlings. In the 18th century it was united with the order of Saint Lazarus by Clement XIII. Also the name of the principal military order in France instituted in 1578, abolished in 1789, revived at the Restoration and finally abolished in 1830.

HOLY GHOST FLOWER, or **HOLY SPIRIT PLANT.** See DOVE PLANT.

HOLY LAND, a name given by Mohammedans to Arabia because it was the birthplace of Mohammed; also by Buddhists to India because it was the country of Sakya Muni. It is a common name of Palestine, because the place where Christ lived when upon earth. See PALESTINE.

HOLY LIVING AND HOLY DYING. 'The Rule and Exercises of Holy Living' and 'The Rule and Exercises of Holy Dying,' companion works by the celebrated Anglican divine, Jeremy Taylor, were published in 1650 and 1651 respectively. They are religious treatises designed to give, in the one case, a rule for virtuous conduct in all the circumstances of life, and, in the other, "the means and instruments" of preparing for a blessed death. Besides counsels, meditations and minute instructions, the author gives numerous prayers and devotions, some of them among the most beautiful in English. The practical character of these works, the wisdom, piety and spiritual beauty which inform them, and the universality of their appeal to those who are striving after the Christian life, have given them a wide and permanent popularity. They have won, also, what is denied to most purely devotional works, an assured place in English literature. For their beauty is not of content alone. In style Taylor is perhaps the noblest representative of the wonderful prose writing of the 17th century and particularly of the great tradition of religious and ecclesiastical eloquence which coincided with the reign of Charles I. He employs the magnificent rhetoric of his age without the obscurity and affectation of many of its writers. The sentences are very long, but they are less involved than those of Milton and Sir Thomas Browne, and their complexities are, as critics have pointed out, often a mere matter of punctuation. The vocabulary, too, is comparatively modern, though Taylor is not wholly without the fondness for strange phraseology which was the inheritance of 17th century stylists from the Renaissance. Mason called Taylor "the Shakespeare of English prose," and the term is appropriate to his catholicity of taste, to his subtlety and variety, and above all to the imaginative qualities which make his prose pages glow with poetic beauty. His is a style full of sensuous imagery, brilliant in metaphor, abounding in sonorous cadences. Like the Elizabethans he is delicately sensitive to the phenomena of nature and makes frequent use of similes and illustrations drawn from the world of eye and ear. "But so have I seen a rose newly springing from the clefts of its hood, and at first it was fair as the morning and full with the dew of heaven as a lamb's fleece; but when a ruder breath had forced open its virgin modesty and dismantled its too youthful and unripe retirements, it began to put on darkness and to decline to softness and the symptoms of a sickly age: it bowed the head and broke its stalk, and at night, having lost some of its leaves and all its beauty, it fell into the portion of weed and outworn faces."

Of the two works 'Holy Living' is on the whole less interesting from the literary point of view. Practical considerations were uppermost in the author's mind. In 'Holy Dying' Taylor, stirred by the memory of a recent sorrow, throws all his powers into the theme and produces a work in which the eternal truisms about death are dignified and ennobled, and made to throb with personal emotion. His view of death is sane and temperate. Avoiding the tendency to dwell morbidly on the hideous images of the sepulchre, he comforts and fortifies the soul until sickness and misfortune and the inevitable end itself come to appear a blessing. The best complete edition of Taylor's writings is that of Reginald Heber, revised by C. P. Eden (1845–52). Reprints of 'Holy Living' and 'Holy Dying' are very common. Consult Edmund Gosse's 'Jeremy Taylor' (in the 'English Men of Letters Series,' 1904), and especially the remarks of Coleridge, 'Literary Remains' (Vol. III, 1836).

J. H. HANFORD.

HOLY ORDERS, the several ranks of the ministry of a church; also the power or authority to exercise that ministry.

In the Roman Catholic Church, Holy Orders is one of the sacraments and there are seven orders of the ministry, viz.: priesthood, deaconate, and sub-deaconate: these are the greater or sacred orders; and the four minor orders of lector, acolyte, exorcist, and doorkeeper. Usually the episcopate is classed, not as a separate order, but as the completion and extension of the priesthood. Though every candidate for the priesthood is inducted into the four minor orders and the sub-deaconate and deaconate before he receives priestly ordination, it happens very seldom that a man enters any of those inferior orders intending to remain therein: they are simply steps to the priesthood.

In the Oriental churches, both those in communion with the Roman See — as the Greek Uniate, the Maronite, the United Armenian, etc., and those which are separated from Rome by schism or by heresy, the number of orders is less than in the Latin Church; in all the foregoing churches only four orders or, counting the episcopate as a distinct order, five orders are recognized; those of bishop, priest, deacon and lector: and of these the first three, at least, are held to be of divine institution and sacramental.

By the Anglican Church and the Protestant Episcopal Church of the United States three orders are recognized: those of bishops, priests and deacons but in the 25th of the Articles of Religion those orders are expressly declared to be no sacrament.

The orders of the Oriental churches are generally recognized as valid by the Church of Rome; and when a priest of any of those churches is received into the Roman Catholic Church he is still regarded as a priest: but an Anglican or a Protestant Episcopal Minister enters the Latin Church as a simple layman even though he were in Anglicanism a bishop; for Anglican orders have ever been held by Rome to be invalid.

Generally, the non-episcopal churches, such as the Presbyterian and Lutheran, recognize but one order as having valid scriptural authority, that of the teaching presbyter. Congregationalists and Baptists recognize their pastors as members set apart for the functions of ministry, but not as setting up any essential difference between them and laymen.

HOLY ROMAN EMPIRE. The Roman Empire, which Julius Cæsar's nephew Octavianus won for himself at the battle of Actium, B.C. 31, remained for centuries undivided. Even when Constantine the Great transferred the seat of government from Rome to Constantinope, A.D. 326–28, the Roman Empire still continued intact. Not until 364 was it partitioned into an Eastern and a Western realm by Valentinian I. The empire was finally divided in 395 between Arcadius, who took the Eastern, and Honorius, who took the Western provinces. This separation, however, was made for administrative purposes only, and the two realms were still regarded as forming a single empire. In 476 Odoacer brought the Western line to an end by forcing the abdication of Romulus Augustulus. Thenceforward until 800, the emperor reigning at Constantinople was, in theory at least, ruler of the whole Roman Empire.

In 751, with the authorization of Pope Zacharias, Pepin the Short, Mayor of the Palace in Gaul, became king of the Franks in place of the deposed Childeric III, last of the Merovingians, and in 754 the new monarch was anointed and crowned by Pope Stephen II. Pepin's son and successor Charles, known as the Great or Charlemagne, became successively king of the Franks of Neustria (758) and of the Franks of Austrasia (771). He conquered the Saxons (772–803), and, having attacked the Lombards (773–74), he added North Italy to his territories and was recognized as suzerain of Rome. In 797, the Empress Irene having deposed and blinded her son, the Eastern Emperor Constantine VI, the time seemed ripe for the reestablishment of the Western branch of the empire, and the man for the imperial office was at hand. Charlemagne was now unquestioned master of western Europe, and was recognized as Champion of the Faith and Defender of the Holy See. In 800 he entered Rome with his Frankish host, and on Christmas Day of that year he was crowned emperor by Pope Leo III. From that event dates the establishment of the Holy Roman Empire, which, through all the shocks and changes of time, survived until the year 1806. After some negotiations, Charlemagne was in time recognized by the Eastern monarchs as emperor and as ruler of northern Italy except Venice, southern Italy and Sicily remaining subject to Constantinople. Charlemagne was succeeded in 814 by his son Lewis I, the Pious, whom he had crowned as coemperor in the previous year. His line continued to hold sway until the death of Charles III, the Fat, in 888. After that event, the dominions of Charlemagne fell asunder and the Carolingian empire disappeared. There then succeeded a period of turbulence, during which the empire subsisted but little more than in name. Phantom emperors, like Guido of Spoleto, his son Lambert, Arnulf, Duke of Carinthia, Lewis III, and Berengar, appeared, but, if they reigned, they certainly did not rule.

A great change was effected on the accession of Otto I, the Great, founder of the Saxon line. Crowned king of the East Franks at Aachen in 936, he continued the work of his father, Henry I, the Fowler, and consolidated his kingdom by a series of conquests. On the invitation of the Pope, he descended from the Alps with a powerful army, was acknowledged king of Italy at Pavia, and was crowned emperor at Rome in 962. One of his first acts was to convoke a synod in Saint Peter's, at which Pope John XII was deposed and Leo VIII was elected in his stead. From the latter Pope, Otto received a confirmation of that veto on papal elections which the citizens of Rome had bestowed upon him on the occasion of his coronation. He continued to extend his conquests, and after a wise and glorious reign he transmitted his power and his titles to his son Otto II (973–83) and his grandson Otto III (983–1002). With the latter the direct line of Otto the Great ended, but there was one more Saxon emperor, Henry II, the Saint (1002–24).

The Franconian line of emperors was established by Conrad II, the Salic (1024–39). Under his son and successor, Henry III, the Black (1039–56), the empire attained perhaps its maximum of strength. Henry was powerful in Germany and successful in foreign wars, and he received from a Roman synod the right of nominating the Pope. In the reign of Henry IV (1056–1106), the great struggle for supremacy between the empire and the papacy began. In 1059 Pope Nicholas II, at the instigation of the famous archdeacon Hildebrand, afterward Pope Gregory VII, vested the papal election in the college of cardinals, reserving the rights of the clergy and people of Rome and of the emperor. When Hildebrand as Pope declared it criminal for an ecclesiastic to receive a benefice from a layman, he raised the whole question of feudal investiture of land to the clergy. It had a special bearing on Germany, where a great part of the land and wealth was vested in bishops and abbots, who, under the new ruling, could pass from the control of the emperor to that of the Pope. A war between the secular and the religious powers was thereupon begun. Gregory summoned Henry to Rome for judgment: Henry retaliated by convening a synod which deposed the Pope. The Pope's reply was to excommunicate Henry, who, deserted by his nobles, went as a penitent to Canosa in 1077, and, clad in woolen and standing barefoot on the snow, sued and obtained forgiveness from the successor of the Fisherman. It was a scene well calculated to strike the imagination, and the admission that the spiritual was greater than the temporal power was destined to have momentous consequences. Henry's son, Henry V (1106–25), was as able and determined an opponent of the papal claims as his father. He asserted all the rights over ecclesiastics which had ever been enjoyed by his predecessors, and it was not until the Concordat of Worms (1122), concluded between Pope Calixtus II and Henry V, that a settlement, greatly diminishing the emperor's powers, was effected. Another blow at the emperor's prerogative came from a different source. On the death of Henry in 1125, the elective principle was established instead of the hereditary. It was by election that Lothar II, of Saxony (1125–38), Conrad III (1138–52), founder of the Swabian or Hohenstaufen line, and Conrad's nephew, Frederick I, Barbarossa (1152–90), succeeded. The reign of the last mentioned was a glorious one, but it was marked by a long struggle with the papacy. There were early bickerings between Frederick and Pope Hadrian IV. On the death of the latter in 1159 there was a disputed papal election, the real Pope being Alexander III, while Barbarossa took the side of the anti-Pope, Victor IV. A fierce contest between Pope and emperor ensued. After the defeat of the imperial army by the allied North Italian cities at Legnano in 1176, Frederick surrendered, and he and Alexander III were reconciled at Venice in 1177. At their meeting, Frederick, it is said, knelt in awe, but the Pope raised him and gave him the kiss of peace. The scene, which has been variously represented, marked the abandonment by the secular power of a contest in which it had now been twice beaten. Frederick led a great German army on the third Crusade, and was drowned in the river Kalykadnus in Cilicia in 1190. He was succeeded by his eldest son, Henry VI (1190–97), who had already as a child been chosen king and crowned at Aachen. Henry endeavored to have the crown pronounced hereditary in his family, but met with so much opposition that he had to be content with procuring the election of his infant son, Frederick II, as king of the Romans. On Henry's death that election was set aside, and a contest for the crown ensued between Otto of Brunswick and Philip of Hohenstaufen, which was not terminated until the murder of Philip in 1208. Otto IV was then formally re-elected emperor and was crowned in 1209. He was, however, excommunicated and declared deposed by Pope Innocent III, and was dethroned by the youthful Frederick II, son of Henry VI. Frederick's whole reign (1212–50) was embittered by a dispute with the papacy, which continued through the reign of his son, Conrad IV (1250–54). Conrad's son, Conradin, the last of the Hohenstaufen house, never reigned. Fighting for his rights, he was defeated as a lad of 15 at Tagliacozzo and beheaded at Naples in 1268.

On the death of Conrad IV there was an interregnum, nominally broken in 1257 by the election of Richard, Earl of Cornwall, and a little later of Alfonso X of Castile, who theoretically were rival emperors, but, while Richard was crowned at Aachen, neither he nor Alfonso was ever crowned as emperor at Rome. During this time conditions in Germany were frightful, and in an attempt to cope with the disorganization, the electors in 1273 chose Rudolf, Count of Hapsburg, founder of the house of Austria, as the occupant of the imperial throne. He, too, was crowned at Aachen, but not at Rome. Dying in 1291, he was succeeded in 1292 by Adolf, Count of Nassau, who was killed in battle (1298) by Rudolf's son, Albert of Hapsburg, Duke of Austria. Albert was thereupon chosen king of Germany and crowned at Aachen. Pope Boniface VIII refused at first to recognize him, but subsequently, in 1303, became reconciled to him, and invited him to Rome to be crowned, an invitation of which Albert never availed himself. He was killed in 1308 by his nephew John. Henry VII, Count of Luxemburg, was then chosen king, and in 1310 was crowned emperor at Rome by the legates of Pope Clement V, who in 1305 had removed the papal court to Avignon in the then kingdom of Arles. On Henry's death in 1313, a double election took place, Lewis IV, Duke of Bavaria, and Frederick, Duke of Austria, being chosen by different sections of the electors. A civil war followed. Lewis defeated Frederick at Mühldorf in 1322 and took him prisoner. In 1324 Lewis came to an open rupture with Pope John XXII, who excommunicated him. Nothing daunted, however, Lewis marched on Rome (1327), where he was welcomed by the Roman people and was crowned emperor in 1328 by four lay syndics named for that purpose by the people. Lewis soon afterward was obliged to quit Rome and Italy, and on his return to Germany he endeavored to conciliate the Pope, who, however, insisted on absolute submission, but this Lewis was not prepared to give. In 1343 Pope Clement VI set up Charles IV, king of Bohemia, as rival emperor and his selection was confirmed by a majority of the electors. On the death of Lewis in 1347 the electors chose in turn Edward III, king of England, who because of the objection of his Parliament declined the honor; Frederick, Marquis of Meissen, who was bought off by Charles; and Günther of Schwartzburg, who accepted but died soon afterward. Charles was then rechosen and recrowned at Aachen. In 1354 he was crowned king of Italy at Milan and finally emperor at Rome by the cardinal-bishop of Ostia, who was deputed to perform that function by Pope Innocent VI. In 1355 Charles IV gave up to the Pope all the territorial rights over Rome and Italy which his predecessors had claimed and asserted in arms.

In 1356 Charles promulgated the celebrated Golden Bull (Aurea Bulla), which settled the composition of the electoral college, the proceedings at elections, and the privileges of the electors. Seven electors were named: the Archbishops of Mainz, Trèves, and Cologne; the King of Bohemia, cupbearer; the Count Palatine of the Rhine, seneschal; the Duke of Saxony, marshal; and the Margrave of Brandenburg, chamberlain.

Charles IV died in 1378, and was succeeded by his son Wenzel, who had been elected and crowned two years earlier. In 1400 Wenzel was pronounced deposed by a majority of the electors, who chose Rupert of Wittelsbach, Count Palatine of the Rhine, in his stead. Wenzel, however, retained his title and his kingdom of Bohemia until 1410–11, when a disputed election took place between Wenzel's brother, Sigismund, king of Hungary, and Jobst, Margrave of Moravia. On the death of Jobst, Sigismund was again chosen in 1414 and crowned at Aachen and in 1431 he was crowned king at Milan and in 1433 emperor at Rome. On his death in 1437, his son-in-law, Albert of Hapsburg, Duke of Austria and king of Hungary and Bohemia, was elected (1438) king of the Romans. He died in 1439 without having received the imperial crown. He was succeeded in 1440 by Frederick III, of Hapsburg, Duke of Styria, who was crowned emperor at Rome in 1452. His was the last imperial coronation that took place there. In 1493 Frederick died and was succeeded by his son Maximilian I of Hapsburg (1493–1519), who had been already elected. On Maximilian's death in 1519 his grandson Charles V (1519–58), king of Spain, was elected emperor and was crowned at Bologna, not at Rome. Charles abdicated in 1555, and on his death in 1558 was succeeded by his brother Ferdinand I (1558–64), who had been already elected. He in turn was succeeded by his son Maximilian II (1564–76), Maximilian by his son Rudolf II (1576–1612), and Rudolf by his brother Matthias (1612–19).

On the death of Matthias his cousin Ferdinand II, of Styria, became emperor and reigned from 1619 to 1637. Ferdinand made a change in the electoral college in 1623 by taking away the electorate from Frederick, Count Palatine, and bestowing it upon Maximilian of Bavaria. The Count Palatine recovered his electoral rights in 1648, thus making eight electors, and a ninth was created in 1692 when the Duke of Brunswick-Lüneburg was given the electorate of Hanover.

The emperors who followed Ferdinand II were Ferdinand III (1637–58), Leopold I (1658–1705), Joseph I (1705–11), Charles VI (1711–40). From the election of Albert II in 1438 to the death of Charles VI in 1740, the empire had remained in the possession of the Hapsburg family. With the decease of the last-named monarch, the male line of the Hapsburgs became extinct, and Charles VII, Elector of Bavaria, was selected to fill the vacant throne (1742–45). When Charles died, Francis I, duke of Lorraine, husband of Maria Theresa, daughter of Charles VI, was elected emperor and crowned at Frankfort, and reigned from 1745 to 1765. In the person of his son, Joseph II (1765–90), already elected in his father's lifetime, the Hapsburg line was restored. Joseph was succeeded by Leopold II, who reigned from 1790 to 1792. On Leopold's death, Francis II, the last of the Holy Roman Emperors, ascended the throne at the fateful period of the French Revolution. In 1804 Napoleon Bonaparte became emperor of the French and regarded himself as the successor of Charlemagne in the empire of the West. In 1805 he overthrew Austria and Russia at Austerlitz and formed the Confederation of the Rhine under the protection of France. By the act establishing the Confederation (17 July 1806), Bavaria, Württemberg, Baden, and 13 other states withdrew from the empire and repudiated its laws, and on 1 August the French ambassador announced to the Diet at Regensburg that Napoleon no longer recognized the existence of the empire. Thereupon Francis II, by a declaration of 6 Aug. 1806, in which he stated that, finding it impossible to carry out the obligations taken at his election, he considered the bonds which attached him to the Germanic body as dissolved, that he released the states of which it consisted from their allegiance, and that he retired to the government of his hereditary dominions under the title of emperor of Austria, resigned the imperial dignity. Thus, in fact, if not perhaps in theory, the Holy Roman Empire came to an end 1,006 years after it had been established by Pope Leo III and Charlemagne. Consult Bryce, 'The Holy Roman Empire' (London 1864, new ed., New York 1904).

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HOLY SEPULCHRE, Jerusalem, the tomb in which the body of Jesus was laid by Joseph of Arimathea the owner of the tomb, and by Nicodemus, «nigh at hand» to Golgotha. As described by John, an eye-witness of the Crucifixion, «in the place where he was crucified there was a garden; and in the garden a new sepulchre, wherein man was never yet laid.» Church records state that after the epochal Council of Nice, 325, Constantine the Great entrusted Bishop Macarius with the task of determining the site of the Crucifixion and the Resurrection. Hadrian's temple of Aphrodite covering the site, according to local tradition, was removed by imperial order, and below, a Jewish tomb cut in the rock was identified as the sepulchre. In a cavity 280 feet eastward, three crosses were also discovered, and the cross on which Jesus died was identified from its faith-healing properties. The present buildings of the church of the Holy Sepulchre, which date from the capture of Jerusalem by the Crusaders in 1099, cover both sites. Great controversy and research arose after the 18th century over the authenticity of the sites, but the traditional emplacement is now generally accepted as accurate. Consult Kinglake, A. W., 'Eothen' (London 1844); Lewis, H., 'The Holy Places of Jerusalem' (London 1888); Warren, (Sir) C., 'The Temple and the Tomb' (London 1880); Wilson, (Sir) C. W., 'Golgotha and the Holy Sepulchre' (London 1906).

HOLY SEPULCHRE, Orders of the. The four orders under this title most deserving of mention are (1) Canons of the Holy Sepulchre, an organization formed originally in the early 12th century, binding together the clerks of the church of the Holy Sepulchre into a community, under Arnulf, patriarch of Jerusalem. It was transferred to Acre in 1187, and spread to the Occident where its houses offered shelters to pilgrims to the Holy Land. Under Innocent VIII, this order was united with the Knights of Saint John, and its independence was practically extinguished. (2) The Canonesses of the Holy Sepulchre, established by the Marchioness Claudia de Moüy at Charleville. Some houses of the order still exist. (3) Knights of the Holy Sepulchre, or Golden Knights, an order of all the knights who in pilgrimages to Palestine had received the accolade at Jerusalem. It was confirmed by Benedict XIV in 1746; and its rule was formulated by Pius IX in 1847. The costume worn is a white mantle with the red cross of Godfrey de Bouillon. The order comprises three classes: knights, commanders and grand crosses. (4) Fathers of the Holy Sepulchre, the group of Franciscans stationed in Jerusalem to protect the Holy Places. Their chief house is San Salvator in Jerusalem.

HOLY WAR, The. 'The Holy War,' written by John Bunyan about 1684, is an allegory of sufficient excellence to have brought fame and immortality to any man. Even though in all its imagery and nomenclature it belongs to a by-gone age, doing unpardonable violence to many scriptural texts, and careless of theological accuracy, it still has power to grip with an interest that flows from a seemingly living plot and from the force of dramatic presentation. This masterly piece of literature has been almost obliterated by the brightness of its truly remarkable predecessor, 'The Pilgrim's Progress.' It is however likely that had the order of production and publication been reversed 'The Holy War' would have dropped into second place because it lacks what the 'Progress' has, a hero with a definite and stirringly real personality. The theme of 'The Holy War' and in places the treatment and characters remind one of 'Paradise Lost' which without doubt Bunyan had never had knowledge of. Bunyan images man, the soul, or other-than-body man as a «fair and delicate town, a corporation, called Mansoul.» «The first founder and builder of it . . . was one Shaddai,» the name for deity which the author adopts. «This famous town of Mansoul had set in the walls gates in at which to come, out at which to go . . . Eye-gate, Ear-gate, Mouth-gate, Nose-gate and Feel-gate.» The state of Mansoul was at the first perfect in life, loyal and obedient to its king, Shaddai. Diabolus (Devil), originally a servant and prince in Shaddai's government being cast out of office and «down into the horrible pits,» because of rebellion, has determined to revenge himself by making war upon Mansoul and capturing it. Approaching the town «under the shape and in the body of a dragon»—Bunyan's interpretation of the Garden-of-Eden serpent — Diabolus «drew up and sat down before Ear-gate» and attacked with subtle arguments made familiar through the Biblical story. «Lord Innocent» and «Captain Resistance» are slain in the encounter by Diabolus' associates, and «Mr. Recorder» (Conscience) is thrown out of office. The town of Mansoul speedily capitulates and is entirely in the possession of Diabolus who thereupon organizes the life of the town according to his own will and scheme, making his mastery more conspicuously complete by defacing the image of Shaddai which «was in the market-place of Mansoul.» On hearing the news Shaddai «and his Son retired into the privy chamber» to plan for the recovery of Mansoul. Captains «Conviction,» «Judgment» and «Execution» undertake the first campaign. The attacks are all verbal — exhortations to repent, warnings and threats of what Shaddai will do. The attacks fail except in stirring up discord and discontent in Mansoul. Then the king, Shaddai, sends his son, Emmanuel, to «conquer the town of Mansoul.» The expedition is successful and Emmanuel enters the town of Mansoul as conqueror, puts Diabolus in chains and proclaims a full pardon for all in Mansoul who have rebelled against the King Shaddai. The life of Mansoul is reorganized and given a new charter with «Free and full forgiveness» and «everlasting comfort and consolation» as the foremost provisions. But the town does not stay conquered. Under the influence of «Mr. Carnal Security» Mansoul backslides and the warfare is renewed. And so the allegory goes on to picture, as only Bunyan can, the fluctuating fortunes of the struggle between the forces of

Shaddai and Diabolus. It is a most vivid and realistic presentation, by personifying the different sentiments and passions and thoughts, of the idea that the soul of man is the battle ground where Good and Evil fight for the mastery.

Charles Graves.

HOLY WATER, in the Greek and Roman Catholic churches, water which has been consecrated by prayers, exorcism and other ceremonies to sprinkle the faithful and things used for the church. The use of holy or lustral water was borrowed from the Jews, and the same symbolism was employed among the Romans. The Roman Catholic Church considers holy water not only symbolical of the purity of the soul, but in certain cases as effectual in exorcism. Before high mass on Sundays the celebrant sprinkles the people with holy water. At the entrance of all churches is kept a font of holy water, in which those going in and out dip the fingers and bless themselves. The consecration of holy water takes place on Holy Saturday before Easter Sunday.

HOLY WEEK, or **PASSION WEEK**, is that which immmediately precedes Easter. The name Passion Week rather refers to the days following and exclusive of Palm Sunday, since this day, strictly speaking does not commemorate any incident of Christ's passion, but his triumphant entry into Jerusalem. The three chief days of the week are Maundy Thursday (or Holy Thursday), Good Friday and Holy Saturday, the most sacred of all being Good Friday. The observance of Holy Week is of very early origin, and it was known as Great Week, Silent Week, Penitential Week, etc. In the ancient Church of Rome, when any of the ordinary church festivals falls on this week, it is not observed till after Easter. In Rome it used to be observed with much greater solemnity and penitential rigor than now; for the shops are kept open, concerts and other amusements are given, though the theatres are closed. The washing of the feet of poor men is still practised in Roman Catholic churches; and the Pope washes the feet of 13 poor persons, all of whom are priests. In Austria the emperor keeps up the old rite of feet-washing with much ceremony.

HOLYOAKE, hōl'ĭ-ōk, **George Jacob**, English political reformer: b. Birmingham, 13 April 1817; d. Brighton, 22 Jan. 1906. He early became connected with various advance movements in Birmingham. In 1841 he was one of the lecturers chosen to explain Robert Owen's social theories, and next year was imprisoned on a charge of atheism. He supported the Chartist demands, but did not sympathize with their hostility to the Whigs. He took an important part in the agitation for the repeal of the corn laws, and for the repeal of the so-called «taxes upon knowledge.» He was the founder of a purely ethical religion, without theistic element (secularism); and was active as a lecturer and writer in the co-operative movement. His works include ‹The Logic of Death›; ‹The Logic of Life›; ‹The Trial of Theism›; ‹Nature and the Origin of Secularism›; ‹Thirty-three Years of Co-operation› (1872); ‹History of Co-operation in England, Its Literature and Its Advocates› (1875); ‹Among the Americans› (1881); ‹Self Help One Hundred Years Ago› (1888); ‹The Co-operative Movement of To-day› (1891), a short, useful account of the history of co-operation; ‹Sixty Years of an Agitator's Life› (1892), an autobiography; and ‹Jubilee History of the Leeds Co-operative Society› (1897).

HOLYOKE, hōl'yōk, Mass., city in Hampden County, on the Connecticut River and the New York, New Haven and Hartford, and the Boston and Maine railroads, about 75 miles southwest of Boston and eight miles north of Springfield. Holyoke was settled in the last part of the 17th century by people from Ireland, and for some time it was called Ireland Parish. It was incorporated as a part of West Springfield in 1786; but in 1850 it became a distinct town, with its own government, and it was chartered as a city in 1873. Like the other settlements along the shore of the Connecticut, the inhabitants saw the advantages to be derived from the water power. At first only the small streams flowing into the Connecticut were dammed and used for turning machinery; the main stream itself was the great route whereby trade intercourse was established with settlements along its shores. In 1847 the Hadley Falls Company began to devise ways and means of using the water power of the Connecticut River, which at Holyoke had a fall of about 60 feet. In a few years the dam, 1,000 feet in length, was placed across the river, and the water power thus obtained gave Holyoke great opportunities for the establishment of manufacturing industries, and they have been well utilized. For some years it was noted for the number and magnitude of its paper-mills; but other industries now enrich the city. Its chief manufactures are paper, paper-products, thread, cotton and woolen goods, knit goods, alpaca, silk, automobiles, machinery, bicycles, wire, belting, screws, bricks, furniture and school supplies. Some of the public institutions are the College of Music, public library, House of Province Hospital, City Hospital, two orphanages located outside the city limits, Saint Vincent's for girls and Holy Family for boys. A large percentage of the people are of foreign birth or foreign descent. The law which declares: «No minor who cannot read and write the English language can be employed in any factory or commercial enterprise» is rigidly enforced. Evening schools are provided for those who cannot attend school in the day time. The Holyoke Scientific Society has done special and excellent work in American archæology. It owns a valuable collection of Indian relics. Some of the places of interest near the city, and which may be reached by the electric railway, are Mount Holyoke (q.v.), Mount Tom (q.v.) and Springfield. In 1896 the city charter was revised, and the government is now vested in a mayor, who is elected annually, and a city council. The annual income of the city reaches over $3,000,000 and its expenditures are proportionate. The water system, gas and electric-light plants are owned and operated by the city. Pop. 62,852.

HOLYOKE, Mount, a narrow ridge of greenstone, the highest point of which is about 1,120 feet above the sea. It is in Hampshire County, Mass., about one mile east of the Connecticut River, five miles southeast of Northampton and eight miles northeast of Holyoke.

On the summit is a hotel, built in 1821. The hotel can be reached by a carriage road which winds to the top, or by a railway which runs up a steep incline.

HOLYOKE COLLEGE, Mount. See Mount Holyoke College.

HOLYROOD, hō-lĭ-rood, **Palace and Abbey of,** Scotland, the ancient royal residence at Edinburgh (q.v.).

HOLZ, hōlts, **Arno,** German poet: b. Rastenburg, East Prussia, 26 April 1863. He came to Berlin early in life, attended the schools and university there, and made it his permanent home. To write verses seems to have been an early passion with him. Geibel, Heine and Eichendorff were his first models. In honor of the 70th birthday of Geibel, he published his first book of poems, ‹Gedenkbuch› (1884). Soon after he became interested in some of the more modern lyric poets. But he did not find much satisfaction in them, as he wished to fathom scientifically the basis of art and turned to an extreme form of naturalism under the influence of Zola and other moderns. ‹Das Buch der Zeit› (Lieder eines Modernen, 1885), showed this tendency, which he developed into a positive theory in association with Johannes Schlaf. During the years 1887–88 these two men worked together assiduously and produced jointly ‹Papa Hamlet› (1889), a collection of novelistic sketches, supposed to have been translated from the Norweigan of Björne Holmsen. In these stories the action — in so far as one can speak of action — moves forward with the hands of the clock. In their drama, ‹Familie Selicke› (1890) they sacrificed all to their one paramount principle of naturalism.

Holz continued working alone, with much self-confidence, on his theories of art and then tried to put them into practice as a poet, which resulted in the following publications: ‹Die Kunst, ihr Wesen und ihre Gesetze› (1891); ‹Die Socialaristokraten› (comedy, 1896); ‹Phantasus› (poems, 1899); ‹Die Revolution der Lyrik› (1899); ‹Dafnis, Lieder auf einer alten Laute› (1903–04); ‹Traumulus› (Schauspiel, 1904); and ‹Ignorabimus› (Tragödie, 1913). Holz must be given an important position among the writers who influenced the trend of literary events in Germany in the last decades of the 19th century. It is only necessary to mention his influence on Hauptmann and Sudermann. No permanent works of art were produced by him and he has been much overrated in this respect by his admirers, but as a stimulating force, as a producer of new ideas on art, he has a secure place in literary history. Consult Strobl, Dr. Karl, ‹Arno Holz und die Jüngstdeutsche Bewegung› (1902); Resz, Robert, ‹Arno Holz und seine Künstlerische Bedeutung› (Dresden 1913); Lessing, O. E., ‹Masters in Modern German Literature› (Dresden 1912).

William F. Hauhart.

HOLZAMER, hōlts'äm-ėr, **Wilhelm,** German novelist and short-story writer: b. Nieder-Olm, near Mainz, 28 March 1870; d. Berlin, 28 Aug. 1907. He was the son of an artisan and first prepared himself for the calling of a common school teacher, serving in that capacity at the Realschule of Heppenheim an der Bergstrasse from 1892 to 1896. His literary career began during these years, with the production of poems and short stories, and a number of monographs on German writers, prepared for newspapers in Germany and in the United States. After 1896 he devoted himself entirely to literary pursuits, retaining his home at Heppenheim until 1902, when Grand Duke Ernst Ludwig of Hessen, whose attention had been called to the poet in so favorable a manner that he was determined to give him an opportunity to develop his talents, called him to Darmstadt to become his private librarian. After occupying this position for a few years, Holzamer left it and settled in Paris as correspondent for a number of German papers, moving to Berlin in 1905, where he fell sick with diphtheria and died in the Elizabeth Hospital. Only one of his short stories has been translated into English (‹Cellist Behnke› in *The New Review,* April 1914); it gives an excellent idea of his impressionistic word-painting. Among his works are ‹Meine Lieder› (poems, 1892); ‹Auf staubigen Strassen› (sketches, 1898); ‹Im Dorf und draussen› (short stories, 1901); ‹Die Siegesallee› (letters on art, 1902); ‹Ellida Solstratten› (novel, 1904); biographies of ‹Konrad Ferdinand Meyer› and ‹Heinrich Heine› (1905); ‹Der Entgleiste› (novel in 2 vols., 1910).

Jacob Wittmer Hartmann.

HOLZWARTH TURBINE. See Internal Combustion Engine.

HOMATROPIN, hō-măt'rō-pĭn. See Atropine.

HOME, Henry, Lord Kames, Scottish lawyer and author: b. Kames, Berwickshire, 1696; d. Edinburgh, 27 Dec. 1782. He studied law at Edinburgh, and, called to the bar in 1724, soon acquired reputation by a number of publications on the civil and Scottish law. In 1752 he became a judge of session, and assumed the title of Lord Kames. In addition to legal works he published ‹Essays on British Antiquities›; ‹Essays on the Principles of Morality and Natural Religion,› in which he advocates the doctrine of philosophical necessity; ‹Introduction to the Art of Thinking›; and his best-known work, ‹Elements of Criticism,› in which, discarding all arbitrary rules of literary composition, he endeavors to establish a new theory on the principles of human nature. In 1776 he published the ‹Gentleman Farmer›; and in 1781 ‹Loose Thoughts on Education.›

HOME, The (Hemmet). In her novel ‹The Home› (or ‹Family Sorrows and Joys›), written in 1839, Fredrika Bremer produced her masterpiece. Though not as absorbing as ‹Grannarne,› which was translated into many languages and made her famous, it is more true to life. Though the plan of construction shows a certain weakness, the characters are drawn with superior skill. The chief character is Elisa Frank, and her relations to her husband, Judge Frank, and her children form the main theme. Fredrika and her own sisters served as models for the daughters whose characters are convincingly described. Petrea, «ready to give away indiscriminately the presents which had been given to her,» is the author herself. Tenderness is shown in the description of the death of Henrik (her brother August), while her humor is at its best where Petrea and Jeremiah are described. In ‹The Home› we see Fredrika Bremer for the first time as the champion of woman's emancipation and advancement. For years afterward, and especially after her return from a visit to America, it became her aim in life to deliver also the Swedish woman from the restrictions in her social position. Long before she wrote 'The Home' the social conditions which confined woman's activities within very narrow limits and left her helpless, unless she was "happily" married, had aroused the author's indignation. Her bitterness increased when Göta Superior Court expressed its narrow-minded opposition to the proposition that women, at the age of 25, should have the legal right to manage their own affairs. Through the study of the writings of Harriet Martineau she had become convinced that reform by law was necessary. 'The Home' has been translated into English by Mary Howitt.

GISLE BOTHNE.

HOME ECONOMICS. Home economics is the organized body of knowledge which treats of food, clothing, shelter and household management in their physical, economic and social aspects as related to the life and welfare of the individual, the family and the community.

As a subject for formal instruction and a field for investigation home economics is concerned with living places, the materials used in them, the arts by which they are maintained for families or other groups of people bound together by kinship, affection or necessity, and with the methods by which they can be made to contribute to the length, happiness and productiveness of the individual life. The forms that instruction takes and the lines that investigation follows depend largely on the character and purposes of the educational institution into which the subject is introduced. It takes in one institution the form of applied science, in another that of manual training, while in still others it appears as branches of vocational or normal training or of economics.

Though its subject matter had long received the attention and thought of students and writers, and though a large body of knowledge had accumulated as a result of housekeepers' experience, home economics did not find an established place as a recognized subject for formal instruction until about 1870, when it was introduced into the State agricultural colleges of the United States. In these institutions which were founded for the benefit of regions where the interests of the home and those of the industry that chiefly supports it are very closely allied, it developed rapidly as an applied science side by side with agriculture, and benefited by the same investigational work in the sciences, particularly those that have a bearing on nutrition and diet. It has drawn from these investigations suggestions for the means of improving the methods by which families are fed and clothed and protected from the elements, and has in turn reacted upon them and encouraged further research. By so doing it has added to its own content and its own cultural value, with the result that it is now often given a place in the courses of study of higher institutions of learning from which applied science, as such, is excluded.

As a branch of manual training, home economics first found a place in the elementary and secondary schools. When the curriculum of these schools was enlarged to include hand training, the particular exercises given to girls were naturally those connected with traditional home industries,— cooking, sewing and cleaning. Even weaving and other handicrafts that had left the home were introduced for the understanding they give of the development of the home as well as for their value in training eye and hand. The rapid development of these subjects in the lower schools and the demand for instructors led to the establishment of teachers' training courses, and promoted serious investigations into the pedagogical value of the subject, and into the question of the forms in which it should be presented in order to meet the changing needs of public schools which represent the only formal education obtained by the vast majority of people. The importance of this pedagogical problem at a time of rapid changes in social and industrial conditions, all of which affected the home, tended to add still further to the subject matter of home economics.

Extension work in household arts for the benefit of those already engaged in home making, and therefore unable to attend school, has for many years been a part of the courses in home economics in agricultural and other colleges. The value of this work was recognized and its possibilities for usefulness greatly increased when in 1914 Congress passed the Smith-Lever Extension Act which made Federal funds available for the promotion of extension work in agriculture and home economics in the various States under certain conditions which include grants of funds from the States co-operating. The general administration of these funds was given to the United States Department of Agriculture, and particularly to the States Relations Service, which cooperates with the various States through their agricultural colleges. At the time of the passage of this act a form of home economics instruction known as home demonstration was already being carried on by the Department of Agriculture. Practical demonstrations of the best methods of canning, cookery and doing other forms of housework were made for the benefit of the housekeepers of a given community. This work, and also education through clubs, classes and lectures, has been greatly enlarged since the passage of the act. Originally limited to rural regions, the work has since been broadened to cover urban districts also.

On still another side the subject has developed as the result of a growing demand for vocational education. The arts by which satisfactory homes are maintained, cooking, sewing, cleaning, etc., have always been followed by women outside of the home as a means of earning a livelihood. The opportunities for such employment have increased as changed conditions of living have called for the establishment of a greater number of hotels, restaurants, boarding-houses, public institutions and other places where food is prepared in large quantities. A vocation which can be followed in maintaining a home and also as a means of livelihood is particularly desirable for women who as a rule spend a comparatively short time in industrial work outside their own homes. This fact has been recognized by the Federal government in the passage of the Smith-Hughes

Act in 1917. This gives Federal aid to vocational education in many subjects, including home economics. Under this form of education according to the provisions of the act, home making and industrial activities which may be the means of earning a livelihood are included within the range of home economics.

Shortly after the passage of the Smith-Lever Extension Act the Nutrition Investigations work of the Department of Agriculture, which since 1892 had been a large contributor to the subject matter of home economics, was expanded into the Office of Home Economics of the States Relations Service. The appropriation for this work is made "to investigate the relative utility and economy of agricultural products for food, clothing and other uses in the home, with special suggestions of plans and methods for the more effective utilization of such products for these purposes." In a general way the Office of Home Economics provides, as a result of laboratory and other technical studies, material for the use of teachers, students and trained workers, as well as a great amount of both popular and more technical literature for general distribution, and also gives attention particularly to subject matter for the instructional work of extension offices of the States Relations Service of the Department. The United States Bureau of Education also deals with home economics, being concerned particularly with methods of teaching in schools of all grades, collegiate, secondary, elementary and normal.

During the progress of the Great War the machinery for teaching home economics was used by government agencies for the purpose of transmitting and interpreting the message of conservation, and the fact that it proved itself useful in the great world crisis without doubt reacted favorably on the subject itself by establishing it in public favor. There can be no doubt that its organization facilitated the carrying out of the programs of the Food and Fuel Administrations and the emergency work of the various permanent departments of the government. In turn its workers were brought into close touch with those who were studying food, clothing and fuel in the light of national and world needs and learned to see home problems in their larger relations.

Although the subject matter of home economics has been formulated in institutions of many different grades and purposes, and although as a field of investigation it has been marked off as the result of the recognition of the large number of social needs, the tendency is not toward further separation into a large number of subjects, but toward formulation into a systematic body of knowledge which can be presented progressively from the lowest schools to the highest. So broadened, it is a subject of universal interest, and deserves a place in general education, since it deals with the natural, social and economic foundations of home life. The tendency is to give to the broad, general, inclusive subject the name home economics, and to apply such terms as household economics, domestic science, cooking, sewing, textiles, etc., to its various branches. This usage is favored by the tendencies in the field of general economics, which though it originally considered little besides the production and the distribution of material wealth now includes the consumption or use of wealth. Even when the satisfactory consumption of wealth, involving, as it necessarily does, healthful food, clothing and shelter, is looked upon merely as a means of increasing the productiveness of the individual it must include the home-making subjects. There is, however, another tendency in economics which is often described as humanizing. This tendency reflects a tendency in society to recognize the individual's value to himself apart from the value of the material wealth which he is able to create. This naturally directs attention to the importance of leisure in the life of the individual. It tends to emphasize the value of the home as the most satisfactory place for the child during the years of preparation for life, for the adult during periods of recuperation after labor, and for the aged during the period of rest at the close of life. Home economics is, therefore, being recognized as a branch of economics concerned largely with the consumption of wealth and its direction toward the enrichment of the individual life. In this form it includes not only a study of the materials that enter into the construction of the house and those that are used for food, clothing, household equipment, furniture and decorations, but also a consideration of the social and economic forces that affect the homes, put them within the reach of different groups of people, and determine their usefulness.

As a pedagogical subject home economics has been systematically codified in a syllabus of home economics which was prepared by the Department of Agriculture in co-operation with the American Home Economics Association.

The literature of the subject is large and growing rapidly.

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HOME EDUCATION. See Supplemental Education.

HOME RULE, the domestic control of local affairs in a province, colony, dependency or integral part of an empire. The term has been employed in recent history most especially with regard to Ireland, which became a dependency of England ever since Pope Hadrian, as is averred, handed it over to Henry II of England in 1155, on condition that a certain portion of its revenue should flow into the treasury of the Holy See. Since that time Ireland has been more or less subject to English government. The Irish are a high-spirited and proud nation, and the history of their subjugation has been a bloody one. For many years, however, they had their own Parliament, and managed their own domestic affairs. Then came what is called the Union. The Irish Parliament was abolished, and Irish constituencies were accorded representation at Westminster to the number of 103. This was in 1801. The Irish Parliament which passed the bill for its own destruction was bribed or cajoled into what the majority of Irishmen of to-day consider a fatal and suicidal act. The first Irishman of note to attempt a remedy for Irish grievances was Daniel O'Connell and his aim, the repeal of the Union, was much more drastic than that of his successors in leadership, who only desire self-government in local affairs, leaving the Imperial Parliament with control over other matters. Catholic emancipation had been won largely through his agitation, seconded by the strong and clear-headed statesmanship of Wellington. In 1834 O'Connell brought forward in the House of Commons his motion for a repeal of the Union. By recent act of Parliament the municipal councils of Ireland had been thrown open to Roman Catholics. O'Connell was elected lord mayor of Dublin, and while his motion for repeal was supported with but 40 votes in Parliament, he carried it by 45 to 15 votes in the municipal chamber at Dublin. This was undoubtedly the earliest step in the movement toward Home Rule, which from that time to the present moment has agitated Ireland. In the town council at Dublin one of the 15 who had voted against O'Connell's motion for the repeal of the union was a brilliant young lawyer named Isaac Butt. Gladstone's measure passed in 1869 for the disestablishment of the Episcopal Church in Ireland was followed by the formation in Dublin in 1870 of the “Home Government Association of Ireland” (later changed to the Irish Home Rule League), with Isaac Butt as one of its founders. Its aim was the establishment of a subordinate parliament in Dublin responsible to an Irish executive. In 1871 Butt was elected member for Limerick, and with him the Home Rule party in the British Parliament was born. From that time Butt brought forward an annual motion in favor of Home Rule, which attracted little public attention in Great Britain; but so effectively was the question agitated in Ireland that at the election of 1874, 60 Home Rulers were returned from that country. With the return of Charles Stewart Parnell in 1875 a new force took the field. He counseled obstructive courses in Parliament with a view to forcing Irish demands on the government — a course that was distasteful to Butt, who, although a true Home Ruler, was conservative in his instincts, and abhorred the obstructionist policy of his younger colleague. Butt died in the spring of 1879, and he was succeeded by William Shaw, who was presently ousted in the leadership by Parnell. With his assumption of the leadership came also a readjustment of the forces behind the Home Rule movement. Butt had received his strength to a considerable extent from the prosperous middle class and Protestant sources, and this was largely withdrawn after 1880. Although Parnell was himself a Protestant, he succeeded, by uniting the Home Rule movement with the agrarian agitation with which the name of the Land League is associated, in winning the support of the “physical force” party, which had hitherto stood aloof, and in obtaining the whole-hearted support of the tenant-farmers.

The period between 1880 and 1885 was an exciting one. Obstruction in Parliament became a fine art; there was continuous political and agrarian agitation in Ireland accompanied by “boycotting” and outrages, these being followed by repressive measures, under which the Irish leader himself suffered imprisonment. In the general election of 1885, the votes of the Irish electors in Great Britain were mainly cast for Conservative candidates, some of whose leaders had indulged in flirtations with the Home Rulers. This election, taken on a widely extended franchise, resulted in a further accession to the strength of the Home Rule or Nationalist party, 85 out of a total Irish representation of 103 being returned, and this party further held the balance of power in the House of Commons. In January 1886 the Nationalists aided the Liberals in overthrowing the Salisbury government, and Mr. Gladstone, after a year in opposition, again resumed the reins. At the general election of 1885 he had appealed for a majority that would make him independent of the Irish vote. That majority had not been accorded him, but he determined to accept the verdict of the Irish people as constitutionally expressed at the polls, announced his conversion to the principle of Home Rule, and immediately thereafter introduced his first Home Rule Bill. In moving the second reading of the measure, he made one of the most powerful and moving speeches in his career. But he had already lost the support of the “Whig” element in his cabinet and in the country, as well as that of Bright and Chamberlain; the second reading was lost by 30 votes, and in the ensuing general election he went down to defeat. The election, however, showed a majority for Home Rule in Ireland, Scotland and Wales; England, the “predominant partner,” returned a great majority against it. The appearance of Parnell in 1890–91 as co-respondent in the O'Shea divorce suit was followed by a request from Gladstone — urged thereto by the English Non-Conformists — for his withdrawal from the leadership, by his deposition at the hands of the majority and the formation of a small party of his personal followers, and by his death in October 1891, which however did nothing to heal the divisions within the party. Under these strokes it appeared for a time as if the cause, that united the warring factions were to suffer eclipse. However, in 1892, Gladstone was again returned to power, with a majority of 40 votes. He again brought in a Home Rule measure, which was carried through all its stages in the House of Commons, but rejected summarily by the House of Lords. Shortly thereafter Gladstone retired from political life, and his immediate successor, Lord Rosebery, was not in sympathy with the Irish demands, and accepted the failure of the Home Rulers to convert England, the “predominant partner,” as conclusive evidence of defeat. The reunion of the Nationalists under John E. Redmond in 1900 was followed by new activity. The accession of Sir Henry Campbell-Bannerman to power as Prime Minister in December 1905 (following on the long Unionist régime, 1895–1905) was regarded as of happy augury for the success of Home Rule, and on his death in April 1908, he was succeeded in the premiership by Mr. Asquith. The hotly-contested elections of 1910 resulted in drawn battles as between

Liberals and Unionists, and gave the balance of power to the Nationalists and Laborists. Mr. Asquith introduced a Home Rule bill on 11 April 1912 providing for a bicameral Parliament, a Senate of 40 members nominated in the first instance by the British government, and a House of Commons of 164 members, responsible to an Irish executive. Peace and war, treaties, navy and army, trade and navigation, coast defense, coinage, stamps, weights and measures, copyright, religion and freemasonry are subjects reserved for the Imperial Parliament. Ireland was to have 42 representatives in the British House of Commons. (A subsequent amendment provided for election to the Irish House of Commons on a basis of proportional representation, and the Senate after an interval of five years was to be elected by this method). This bill passed the House of Commons on 16 Jan. 1913, and was rejected by the House of Lords on 30 January. The bill was reintroduced in the summer session, passing its third reading in the House of Commons on 17 July. The government refused the Unionist demand that the bill should be the occasion of a reference to the country, and a third time was passed by the House of Commons on 25 May 1914. An amending bill had been introduced by the Premier providing that those counties of Ulster which should by referendum so determine, be excluded from the act for a period of six years. This was a concession made to the demands and threats of the Unionists of Ulster, who, under the leadership of Sir Edward Carson (q.v.), declared themselves unalterably opposed to being forced into allegiance to a Dublin Parliament, and had pledged themselves to armed resistance. Further difficulties were introduced by an undertaking given by the War Secretary to certain army officers that they would not be required to take up arms against Ulster in revolt against Home Rule, which was followed by the repudiation of the pledge by the government and the resignation of Colonel Seely, the War Secretary, and by the assumption of the War Secretaryship by Mr. Asquith. Meantime negotiations to effect a settlement by consent had proved abortive. So matters stood at the declaration of war on Germany on 4 August 1914. Mr. Asquith announced his intention to introduce a suspensory bill postponing the inauguration of Home Rule in Ireland for a twelvemonth or until the conclusion of the war. This measure received the royal assent on 17 September, and the Home Rule Act — under the provisions of the Parliament Act, passed in 1911 with the object of curtailing the powers of rejection up till that time possessed by the House of Lords — automatically became law without further reference to that branch of the legislature.

Following on the serious revolt in Ireland in Easter Week of 1916, an effort was made by the government to bring in Home Rule by consent of the various factions, and Mr. Lloyd George was the minister deputed to undertake these difficult and delicate negotiations. Success seemed to attend his efforts, for a basis of agreement was reached. The 78 members then sitting in the Imperial Parliament for the 26 Home Rule counties were to form the Dublin Parliament, and the 25 members from the six excluded Ulster counties were to remain at Westminster. Among those who thus accepted seats in the new Parliament were Sir Edward Carson and Mr. J. H. M. Campbell, the attorney-general for Ireland. This temporary settlement was to continue for one year after the war, when the whole question was to be considered at a Great Imperial Conference of all the dominions. On two points, however, the agreement failed to command the assent of the Unionist party. The first point dealt with the means by which the exclusion of the six Ulster counties was to continue or be brought to an end, the Unionist contention being that only by their full consent could they be brought in. Under the agreement the Irish members were to remain in undiminished numbers at Westminster until a permanent settlement had been carried through and embodied in an act of Parliament. The Unionists found it quite impossible to vote for a proposal which would maintain the Irish members in undiminished numbers after a general election and after a Home Rule government had been set up in Ireland. On these points the proposed settlement broke down, and for their failure to ratify it the government was strongly assailed by Mr. Redmond and the other Irish leaders. The former rule of government from Dublin Castle — abolished after the revolt — was again set up, Mr. Henry Edward Duke, a Unionist member of Parliament, being appointed chief secretary on 31 July, and Lord Wimborne appointed to his former office of Lord Lieutenant on 6 August. See also SINN FEIN MOVEMENT.

In addition to the movement for Irish Home Rule — under the name of «Home Rule all Round» — a similar movement has been inaugurated with the aim of setting up national Parliaments in Scotland and Wales. So far, however, no responsible British government has stood sponsor for them.

Bibliography.— There is extensive literature on the subject. The published speeches of the great political leaders in the United Kingdom — Gladstone, Morley, Chamberlain, Balfour, Asquith, Parnell and Redmond should be consulted. 'Gladstone's Life' by Morley is specially valuable, as are also Gladstone, 'Special Aspects of the Irish Question' (1887); McCarthy, 'The Case for Home Rule' (1892); Chamberlain, 'Home Rule and the Irish Question' (1887); Anderson, 'Sidelights on the Home Rule Movement' (1906); O'Donnell, 'History of the Irish Parliamentary Party' (2 vols., 1910); Redmond, 'Home Rule' (1910); 'The Home Rule Bill' (1912); Balfour, 'Against Home Rule: The Case for the Union' (1912); 'Nationality and Home Rule' (1914).

HOME RULE, Municipal. See MUNICIPAL GOVERNMENT.

HOMER is merely a name for the unknown authorship of the 'Iliad' and the 'Odyssey,' the two noble epics that stand at the beginning of Greek literature. Poems so exquisite cannot really be a beginning either in thought, language or metre. They presuppose a complex evolution of legend and a long apprenticeship to the poetic art. But for our knowledge they are still a beginning. We know that «the work of Homer is the most admirable product of human poetry» (Sainte-Beuve); that «the ‘Iliad’ is the most important poetical monument existing» (Matthew Arnold); that «the ‘Odyssey’ is the only long poem that is never dull» (Lowell); that for the teaching and preaching of English literature Homer ranks with Shakespeare and the Authorized Version (Quiller-Couch). But of Homer himself we know nothing save what we deduce from the poems and infer from their descriptions of the *Aoidos* or bard. The Greeks themselves knew nothing. The eight Greek lives that fill 49 pages of Westermann's ‘Vitarum Scriptores’ are manifestly late inventions. They are developments of anecdotes, old epigrams and passages in the hymns attributed to «Homer.» Hence come the patronymic names Melesigenes and Maeonides, the tale of the seven cities that claimed the honor of his birth, «where living Homer begged his daily bread,» the conception of the poet as the blind old bard of Scio's rocky isle (Chios), the legend of his poetical contest with Hesiod and of his suicide because of failure to answer the fisherman's riddle, the tradition of a guild, clan or family of «Homerids» who transmitted the poems to posterity.

All older Greek poetry is reminiscent of Homeric language and phrasing, and there is a sense in which all Greek literature and civilization not to say all European civilization flow from this fountain-head. The earliest mention of Homer's name occurs in the complaint of the philosophic poet, Xenophanes of Colophon, that Homer and Hesiod attributed to the gods actions that would be shameful in men. The historian Herodotus, the first extant prose writer to name and discuss Homer, says that he lived «about four hundred years before my time,» i.e., about 850 B.C. This is consonant with the fact that the ‘Iliad’ and the ‘Odyssey’ speaking of Achæans, Danaans and Hellenes practically ignore the historical division of the Greeks into Dorians, Ionians and Æolians and know nothing of the «return of the Heraclidæ» and the Ionian colonization of Asia Minor with which the history of Greece begins. Back of this historical Greece the new archæology and the spade of Schliemann and Dörpfeld have revealed the so-called Mycenæan civilization of Mycenæ, Tiryns, Hissarlik (Troy) and many other sites, and the discoveries of Sir Arthur Evans and others in Crete have carried the hypothetical history of «Ægean» or «Minoan» civilization back to 2000 B.C. These discoveries have added enormously to the interest of the Homeric poems as documents. The civilization portrayed so minutely in the poems and that reconstructed by «Mycenology,» though closely related are not identical. Their precise relation is still undetermined. The immense literature of speculation on this subject, including such delightful romances as Professor Murray's ‘Rise of the Greek Epic’ and Walter Leaf's ‘Homer and History,’ leave the Homeric problem precisely where Matthew Arnold found it in 1860. «These are questions which have been discussed with learning, with ingenuity, nay with genius . . . but there really exist no data for determining them.» The English reader will find all the facts and the German bibliography in Seymour's ‘Life in the Homeric Age’ (London and New York 1907), and the most reasonable argumentative discussion of the facts and theories in Andrew Lang's three books, ‘Homer and the Epic,’ ‘The World of Homer,’ ‘Homer and His Age.’ Jebb's little ‘Homer’ though now somewhat out of date is still an admirable summary. Another type of speculation about Homer combines critical analysis of the poems with the ancient tradition of their collection, arrangement or recitation at a later date than their composition. Passages in Cicero, the Pseudo-Platonic *Hipparchus,* and Diogenes Laertius speak vaguely of some regulation of the order of the «rhapsodes'» recitations of Homeric poetry at the Panathenaic festival by Peisistratus or Solon or Hipparchus. The literature of the modern Homeric question beginning with Wolf's famous ‘Prolegomena’ (1795) interprets this to mean that the ‘Iliad’ and the ‘Odyssey’ were late compilations of traditional ballad or epic material, and seeks to confirm this notion by disintegrating analysis of the defects in the plot of the poems and the inconsistencies between their parts. The blown bubble of Wolf's reputation is punctured in Victor Bérard's ‘Un mensonge de la science allemande’ (Paris 1917). But apart from the personality of Wolf the entire speculative literature of the Homeric question is a gigantic bluff of modern scholasticism. It can be defended only as alchemy or scholasticism are approved, on the ground that the by-products of so great an intellectual effort have been suggestive and interesting. Neither the facts nor the arguments of any one of the 20 or 30 most prominent books of this literature will endure critical scrutiny. This so-called science always breaks down when challenged by a competent scholar who knows the texts, as may be seen, for example, in many articles published in *Classical Philology* in the past 10 years. When Huxley enumerated in a list of the achievements of science the fact that «the unity of authorship of the ‘Iliad’ was successfully assailed by scientific criticism, he was dogmatizing in dependence on authority about matters which he had not tested and which have now failed to stand the test. There is to-day neither proof nor preponderant probability that the ‘Iliad’ and the ‘Odyssey’ are not in the main the work of one supreme prehistoric Greek poet. The ‘Odyssey’ as we have it is the best constructed long poem in existence, and the ‘Iliad’ even if we concede the long retarding digression in Books II–XI to be a flaw is at least as well constructed as the ‘Æneid’ or ‘Paradise Lost.’ The Homeric poems are doubtless «traditional books.» So are Shakespeare's plays, and there is no presumption that Homer followed his sources more closely than Shakespeare followed North's Plutarch or Lodge's Rosalind. The differences between the ‘Iliad’ and the ‘Odyssey’ are less than those between the earliest and the latest poems of Tennyson and Goethe. And while it may be true that in Augustan ages great poets come in clusters there is no example in literature of two poems so great and so like by different authors. The wise student of literature, then, will not waste his time on these idle speculations but will endeavor by loving study of the poems themselves to appreciate their unique combination of noble literary art with the charm of an earlier, simpler and more natural humanity. Consult Arnold, Matthew, ‘On Translating

Homer'; Pope's Preface to his Translation; Shorey, 'Introduction to edition of Pope's Homer'; Mackail, 'Lectures on Greek Poetry'; Lang, 'Letters to Dead Authors — Homer'; Jebb, 'Lectures on Greek Poetry.' See ILIAD; ODYSSEY.

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HOMER, Winslow, American painter: b. Boston, 24 Feb. 1836; d. Scarboro, Me., 29 Sept. 1910. He studied in the National Academy of Design, and was also a pupil of Frederic Rondel. He was sent to the front during the Civil War as special artist to *Harper's Weekly*, and on his return to New York exhibited his first important work, 'Prisoner from the Front' (1864), which won him recognition. In 1865 he was elected Academician. Taking up his residence in Scarboro, Me., he painted a series of pictures which indicated a marked development in style, sentiment and power. There was a trace of conventionality at least in the subjects of such pictures as 'Home, Sweet Home,' the series of which he painted between 1864 and 1884. From the latter date he began his portrayal of the fisher population of New England. Dramatic and realistic in the highest degree is the series of seven canvases from the 'Life Line' (1884) to the 'Lookout' (1897). But this artist reached his finest vein in his pure marines, of which the greatest is 'The Maine Coast.'

HOMESTEAD, hōm'stĕd, Pa., borough in Allegheny County, on the Monongahela River and on the Pittsburgh and Lake Erie, the Pennsylvania and other railroads, about seven miles south of Pittsburgh. It was settled in 1871 and incorporated and chartered in 1880. The chief manufactures are foundry-products, glass, machinery and steel products. It is noted for its large steel plants, which employ over 7,000 men. The government is vested in a mayor, elected for three years, and a council, which appoints the chiefs of police, street and waterworks departments. The borough owns and operates the waterworks. At one time Andrew Carnegie (q.v.) was the principal owner of the Homestead steel works. Pop. 21,256.

There occurred in Homestead a serious strike which began 6 July 1892. Reductions in wages, change in time of signing the schedule and refusal to recognize the Amalgamated Iron and Steel Association, or to hold any conferences with the men, had brought on a general strike to date from a certain time, and enraged the men into burning H. C. Frick, the manager, in effigv; whereupon the works were at once shut down, 1 July, two days ahead of the agreed time, and the men armed themselves and prepared to resist by violence any attempt to supply their places with non-union men. The advisory committee of the union took charge of the town with regular armed companies, and allowed no one to enter the mills without their permission. On 5 July the company announced an intention to make repairs, and appealed to the sheriff for protection: he sent a small squad, who were at once driven from town by the strikers, the latter denying that any damage was intended and offering to be sworn in as deputies themselves. The company then hired a body of 300 Pinkerton detectives, who came up the river in barges; but the strikers broke through the fence surrounding the mill, entrenched themselves behind a barricade of steel rails and billets, and whenever the Pinkerton men attempted to climb the steep bank (which they began at 4 A.M. of 6 July), shot them down. Next day they procured a 10-pounder brass cannon and bombarded the boat, splintering her wooden sides, but failing to pierce the steel plates within. They then sprayed the boats with oil from a hose, and emptied barrels of it on the river, setting it on fire to float down and fire the boats. The detectives repeatedly ran up flags of truce, which were at once shot down. At length the advisory committee sent delegates to offer a safe-conduct to the detectives, if they would leave their arms and ammunition and quit the town under guard; they were forced to submit, but when leaving under escort, the mob stoned, shot and clubbed them shockingly, one having an eye struck out by a woman in the mob. Seven were killed first and last, and 20 to 30 wounded; and 11 strikers and spectators were killed by their return fire from the boats. The governor (Pattison) refused to use the State power to quell the riot till the 10th, insisting that the local authorities must do their utmost first, and the sheriff must summon the citizens; and the troops did not arrive till the 12th, when the town was put under martial law. A committee of Congress was appointed to investigate the case; and later, a Senate committee in the interest of the strikers was appointed to inquire into the hiring of private armed parties to maintain public order. On 21 July Mr. Frick was shot and stabbed in his office, but recovered. On the 18th a number of strikers were arrested for murder; and retorted by indicting the Carnegie Company, the Pinkerton brothers and five of their men for murder. The advisory committee was also charged with treason and usurpation, in taking military possession of the town. The mills were soon supplied with new men, but the strike was not officially declared «off» till 20 Nov. 1892.

HOMESTEAD EXEMPTIONS, homesteads of a certain value or extent which the law provides shall be exempted from sale on execution or by any final court process. Homestead exemptions differ throughout the States. In Alabama «every homestead not exceeding 80 acres and the dwellings and appurtances thereon» is exempt, if the property is not in any city, town or village; also, any city, town or village lot with its dwellings and appurtenances owned and occupied by a citizen and not exceeding in value $2,000 is exempt. In Florida the exemption is on half-an-acre city or town lot, and on 160 acres in the country. In Texas, the exemptions are on $5,000 city or town lots and on 200-acre counry lots. In Michigan on $1,500 urban lots and country lots of not over 40 acres. Exemption, however, does not extend to lawful mortgages, to payment of purchase obligations and contracts, or from sale for public assessments and taxes. See HOMESTEAD AND LAND LAWS.

HOMESTEAD LAW. The Homestead Law is a series of enactments beginning with the Act of 20 May 1862, which provides for the disposition of the public lands to homemakers without requiring any compensation except the mere acts of residence, cultivation and improvement. A person who is the head of a family or who has reached the age of 21 and who is a citizen of the United States or has declared his intention to become a citizen and who is not the owner of more than 160 acres of land in the United States, may apply for not exceeding 160 acres, and upon residing thereon, cultivating and improving the same for three years in compliance with the law may obtain patent therefor.

There are various modifications of the original law and various extensions by which one may obtain under recent acts 320 acres under what is known as the Enlarged Homestead Law, or as much as 640 acres in Western Nebraska under what is known as the «Kinkaid Act.» The details of these acts will be discussed under this title.

In the beginning of the history of the disposition of the public lands the desire of the people seemed to be to secure a large return as rapidly as possible and many sales of large areas were made in the earlier period. This idea was later followed by the policy of encouraging settlement on the public lands and the building of homes. See the article PUBLIC LANDS.

The home-making idea and the disposition of the public lands gained greater and greater strength until in 1852 it became a national political issue. In that year the Free Soil democracy incorporated in its platform for the Presidential campaign this declaration: «That the public lands of the United States belong to the people, and should not be sold to individuals nor granted to corporations, but should be held as a sacred trust for the benefit of the people, and should be granted in limited quantities, free of cost, to landless settlers.»

This question held the public attention, was discussed and debated and remained a political issue before the people for 10 years. A homestead bill was passed by the House of Representatives in 1859, but after being voted on by the Senate several times failed to pass. In June 1860, after much discussion in both Houses, a homestead bill was agreed upon and presented to President Buchanan, who on 23 June 1860 vetoed the bill.

The provisions of the bill may be summarized as follows: Any citizen of the United States who is the head of a family, and any person of foreign birth residing in the country who has declared his intention to become a citizen, may enter and settle upon not exceeding 160 acres of public land, and, after residing upon it for five years, shall receive patent for the land. The bill also contained a cession to the States of all public lands within their limits which remain unsold after having been subject to sale for 30 years.

The veto message states that the proposed cessions to the States would involve a present donation to them of 12,229,731 acres and would from time to time transfer to them other large bodies of land. President Buchanan stated a number of objections to the bill. His principal point was that the bill was unconstitutional because it made a donation of the public lands to the States and to individuals, holding that the power given by the Constitution to dispose of the public lands did not include the power to give them away. The President objected because of the injustice to the early settlers who had braved the hardships and dangers of frontier life and had paid $1.25 per acre for their lands; also because it would depreciate the value of the land warrants of old soldiers, which were given for their services in fighting the battles of their country. An effort was made in the Senate to pass the bill over the veto, but the necessary two-thirds vote in its favor could not be obtained.

In the political campaign of that year the Free-Homestead Law was an important feature of the discussions of Lincoln and the other candidates. Soon after the opening of the extra session called by President Lincoln to convene 4 July 1861, on account of the troubled conditions in the South, a new homestead bill was introduced in the House of Representatives on 8 July, and it was promptly taken up at the opening of the regular session in December. There was vigorous opposition, and the bill did not pass the House of Representatives till 28 Feb. 1862. The bill was amended in the Senate and passed by that body on 5 May. The two Houses soon after agreed upon a form of bill, and it was finally passed by both Houses on 19 May and approved by President Lincoln on 20 May 1862. The Act as passed differs in only one important particular from the bill which was vetoed, namely, in the omission of the proposed cession of lands to the States.

The Homestead Law has now been on the statute-books for nearly 50 years, substantially as originally enacted. It is regarded as the basis of our land laws and was the most successful of our land policies. The constitutionality of the Act does not seem to have been seriously questioned in the courts.

Under the Homestead Law proper, the applicant is limited to 160 acres and must reside upon the land and make it his home to the exclusion of any other residence during the period of three years. At the end of this time he may make final proof of his residence and of the cultivation and improvement of the land. If this is satisfactory he receives a patent from the United States which conveys to him full title and unrestricted ownership. If a homestead settler dies without having filed application for entry or if having entered he has not submitted final proof, his rights pass to his widow or if there be none then to his heirs or devisees. If all the heirs are minor children and the other parent is dead the right to the patent vests in the children at once.

The laws provide for the commutation of a homestead entry before the completion of the three years' period of residence, after 14 months' continuous residence, and by the payment of $1.25 per acre, or, where the land is within the limits of certain railroad grants, $2.50 per acre and upon the proof of substantial improvements and cultivation of not less than one-sixteenth of the area.

Homestead entrymen are not allowed to alienate any part of the land in the homestead entry prior to making proof except for public purposes, but they may mortgage the land for the purpose of securing money for improvement or for any other purpose not inconsistent with good faith. Only one homestead entry is allowed but where the original homestead entry was less than 160 acres an additional entry of such amounts as not to exceed a total of 160 acres will be allowed.

Beginning with the Act of 19 Feb. 1909 several acts were passed providing for enlarged homesteads not exceeding 320 acres of public land in the States of Arizona, California, Colorado, Idaho, Kansas, Montana, Nevada, New Mexico, North Dakota, Oregon, South Dakota, Utah, Washington and Wyoming, applicable, however, only to lands designated by the Secretary of the Interior as non-mineral, non-timbered, non-irrigable and subject to the said acts. The entryman of an enlarged homestead must reside thereon for three years and must cultivate at least one-sixteenth of the area for agricultural crops other than naked grass, beginning with the second year of the entry, and at least one-eighth of the area must be continually cultivated beginning with the third year.

The Kinkaid Act of 28 April 1904 provides for homestead entries not exceeding 640 acres in western Nebraska except for such lands as may be designated by the Secretary of the Interior as irrigable. The general homestead laws will apply but the entryman must expend not less than $1.25 per acre in permanent improvements. Those who have already made homestead entry may take additional land in the area covered by this Act but the total entered must not exceed 640 acres.

HOMICIDE, hŏm'ĭ-sīd, or man-killing, is either justifiable, excusable or felonious. Of the first sort are such cases as arise from unavoidable necessity or accident, without any imputation of blame or negligence in the party killing. Where a crime is punishable capitally according to the laws, the judge is bound to condemn the criminal to death, and the sheriff or other executive officer to carry the sentence into effect in the manner prescribed by the sentence of condemnation. But the judge must have jurisdiction of the offense, and be duly commissioned; and the executive officer must be empowered to carry the sentence into effect, and must perform the execution in the manner prescribed by law, otherwise the execution of the criminal will make the judge or the officer, as the case may be, guilty of criminal homicide. So, too, where an officer of justice is resisted in the execution of his office, in his attempt to arrest a person in a criminal, or, as is maintained, even in a civil case, he is not obliged to give back, but may repel force with force; and if the person resisting is unavoidably killed, the homicide is justifiable, for few men would quietly submit to arrest if, in case of resistance, the officer was obliged to give back. It is, however, laid down as law that if a felony be committed, and the felon attempts to flee from justice, it is the duty of every private citizen to use his best endeavors to prevent an escape, and if in the fresh pursuit the party be killed where he cannot be taken alive, it will be deemed a justifiable homicide. The same rule applies to cases of an attempt on the part of a felon to break away and escape after he has been arrested, and is on the way to jail. So if a party has been indicted for felony and will not permit himself to be arrested, the officer having a warrant for his arrest may lawfully kill him if he cannot be taken alive. But this is to be understood only of officers, and not of private persons. Magistrates and officers authorized to suppress and disperse mobs are justified by the common law in taking the requisite measures and using the requisite force for this purpose, though it extend to the killing of some of the rioters. The law arms every private citizen in the community with the power of life and death for the prevention of atrocious felonies accompanied with violence and personal danger to others, as in case of an attempt to murder or rob, or commit burglary or arson, the person making the attempt may, by the common law, if he cannot be otherwise prevented, be killed on the spot, and the law will not recognize the act as a crime. In cases of this sort, in order to justify the homicide, it must appear that there were good grounds for a suspicion that the person killed had a felonious intent. A woman is justifiable in killing one who attempts to ravish her, and the husband or father may be justified in killing a man who attempts a rape on his wife or daughter.

The cases already mentioned of justifiable homicide are those in which the public authority and laws are directly concerned. The laws of society, however, leave every individual a portion of that right of personal defense with which he is invested by those of nature. If one may interpose to prevent an atrocious crime against society, where he is not himself in any personal danger, the laws will, a fortiori, permit him to defend himself against attacks upon his own person. Murder is the killing of a person who is under the protection of the laws, with malice prepense, either expressed or implied. Malice is the distinguishing characteristic of murder, and may be either aforethought, or expressed, or implied. It is not necessary in order to constitute the crime of murder that the slayer should have the direct intention of killing. If the act be done with a wicked, depraved, malignant spirit, a heart regardless of social duty, and deliberately bent upon mischief, it is characterized by what the law denominates malice though it may not result from any enmity or grudge against the particular victim. So if a man wantonly discharges a gun among a multitude of people, whereby any one is killed, the act will be done with that depravity of disposition which the law considers malice. Murder can be committed only by a free agent, for the crime presupposes a will, motive or disposition on the part of the perpetrator. An idiot or insane person cannot commit this crime. But drunkenness is in general no excuse for homicide, though the act be done under its immediate influence.

The manner of killing is not material. Whether it be by shooting, poison, beating, imprisonment, starvation or exposure to the inclemency of the atmosphere, it will be equally murder. This crime may be committed by mere advice and encouragement. An infant unborn is within the protection of the law, and it is laid down that if, in consequence of poison given or wounds inflicted before the birth of a child which is afterward born alive, it dies soon after its birth, the act is murder. The act of suicide is considered by the law to be murder, and the person making away with himself is accordingly styled a "self-felon." This view is undoubtedly being modified by public opinion.

The lines of distinction between felonious and excusable or justifiable homicide, and between manslaughter and murder, are in many cases difficult to define with precision. But in general the accused has the advantage of any uncertainty or obscurity that may hang over his case, since the presumptions of law are usually in his favor. The characteristic distinction laid down in law books between murder and manslaughter is the absence of malice in the latter. Sudden provocation may be an excuse for striking another without the intention to give a deadly blow; and though death ensue, the party may not be guilty of murder. One circumstance, showing the degree of malice, or rather showing its presence or absence, is the kind of weapon used in giving a wound on a sudden provocation; and another circumstance of importance is the fact of the weapon's being already in the hand or not, for going to seek a weapon gives time for deliberation. The ground of excuse of homicide, in case of provocation merely, is the supposed sudden passion, some influence of which the law concedes to the frailty of human nature. But the excuse of self-defense goes still further; and where a man is attacked, so that his own life is endangered, or in such way that he may reasonably suppose it to be so, he may repel the attack with mortal weapons. One of the most frequent cases of manslaughter was that occasioned by single combat, and on account of the firm hold which the point of honor had taken of European nations, was long among the most difficult subjects of legislation. (See DUEL). The crime of murder in its most aggravated degree is punished with death in most parts of the civilized world.

HOMILY (Greek, *homilia*, intercourse), as an ecclesiastical term, a discourse addressed to an audience on some subject of religion. The homily was so called to distinguish it from the speeches of profane orators. The ancient homily was sometimes simply a conversation, the prelate talking to the people and interrogating them, and they in turn talking to and interrogating him. The difference between the homily and the sermon was the entire absence of oratorical display from the former, and the elucidation of the Scriptural text in natural order, without throwing the exposition into the form of an essay.

The earliest existing examples of the homily proper are those of Origen in the 3d century. In the schools of Alexandria and Antioch this form of discourse was sedulously cultivated, and Clement of Alexandria, Dionysius and Gregory Thaumaturgus are among the names most eminent in this department. Augustine and Gregory the Great were among the Western composers of homilies. Later still Bede, several of the popes and foreign ecclesiastics still adhered to the homiletic form of exposition as the most suitable to impress the truths of Scripture with efficacy on the popular mind.

In the Church of England there were two books of homilies that were long authoritative, and are still sometimes appealed to to settle disputes as to what the Anglican doctrine is in points on which they bear.

HOMING-PIGEON, a variety of the common pigeon in which the love of home and power of flight have been developed to make the bird useful and reliable as a bearer of messages; also a fancy variety characterized by the possession of certain definite points, but not necessarily useful as a homer. The show carrier-pigeon is a large, long-necked variety, with abnormally developed wattles about the base of the beak and round the eyes, but the true homer is of smaller size and lacks the enormous tuberculated growth.

The training and breeding of homing-pigeons were long almost confined to Belgium, and two main types of the Belgian homer have been distinguished as the Antwerp and the Liége varieties, the former being larger but less graceful in form than the latter. American pigeon fanciers breed mainly from the Antwerp type, and the birds are commonly designated Antwerps.

The training of a homing-pigeon begins when it is about three months old. It may then be taken to a distance of about a mile from its loft in a suitable direction and liberated in order that it may fly back. After an interval of a day or two it should be carried three miles from home in the same direction and set free, and on the third occasion, a few days later still, the distance is usually increased to six miles. This mode of training is continued steadily during the season, the successive distances above those already mentioned being 12, 25, 50, 75, 96, 125, 155 and 200 miles. The intervals of rest must be carefully preserved especially in times when the weather is unfavorable. During the bird's second season it is made to repeat something of its first year's performances and to extend its flight to 250 miles or possibly to a greater distance. During the following three seasons good birds will be at their best, and even for some few years later they may do good work. During the training period and also at other times the housing and feeding of the birds must be carefully attended to.

Velocities of over 30 yards per second have been recorded for various pigeons, but the average velocity is rather less than half that amount. One bird, in 1896, actually covered the distance from Thurso to London, just over 500 miles, within one day, its average velocity being about 24 yards per second. In unfavorable weather the height attained varies from about 320 to rather over 400 feet, but in good weather some birds will reach a height of about 1,000 feet. The distance from Algiers to Paris, fully 1,100 miles, is one of the longest on record as having been traveled by a pigeon.

There has been much discussion regarding the means by which pigeons return to their homes over such long distances. Untrained birds often fail to return, and during training young birds are often lost.

Many instances are recorded of the employment of pigeon messengers by ancient peoples. During the first half of the 19th century pigeons were widely used in Great Britain for the rapid communication of intelligence, and in particular many stockbrokers obtained early information of the state of the markets by this means. The introduction of the electric telegraph, however, soon led to the complete disuse of the pigeon post. The siege of Paris during the Franco-German War of 1870-71 first brought the carrier-pigeon into prominent notice as a valuable means of communication in time of war. During that siege more than 350 birds were sent out of the city in balloons, and of these some 300 were liberated with messages. Only some 70 returns were made, and these were effected by 57 birds. By the adoption of microphotography the space occupied by a message was so reduced that a single pigeon could carry a very large number of messages without having its movements hampered in the least. One of the pigeons that succeeded in returning to Paris carried no less than 40,000 messages on 18 collodion films which were enclosed in a goose-quill attached to the tail. Since that time the leading Continental powers have established elaborate pigeon systems for use in time of war. During the war with Spain, in 1898, the fleet of vessels that patroled the Atlantic Coast was supplied with a number of carrier-pigeons' cotes, but happily there was no occasion for testing their effectiveness, though in times of peace messages are frequently successfully carried from war vessels to points on the shore. During the European War carrier-pigeons were extensively used by all the belligerents. Consult books mentioned under PIGEONS.

HOMINIDÆ, hō-mĭn'ĭ-dē, the family to which man was assigned in the earlier systems of animal classification; but many modern zoologists refuse him so great a distinction, making man, zoologically considered, only a species (*Homo sapiens*) of a genus of the family *Simiidæ*, which also includes the genera of the anthropoid apes. See MAN.

HOMŒOPATHY signifies similar affection, passion, suffering or disease. As employed in medicine, and as understood by Hahnemann and physicians of the homœopathic school, homœopathy may be defined as: the treatment of disease by means of its similimum. The cure is undertaken by a medicine capable of producing in a healthy person symptoms similar to those manifested by the patient. The name or type of the disease, the type or class of the drug administered or the size or strength of the dose have no direct relationship to homœopathy. Nevertheless, it does hold important incidental relationship to the classification of drugs, to the facts and principles of dosage, to diagnosis, to pathology and bacteriology and to all other departments of medicine and allied sciences. Under this definition, the experimental application of homœopathy requires that the drug shall cover the *tout ensemble* — or, as Hahnemann expresses it, the «totality» of the symptoms as exhibited by the patient; and not merely one or a few of the dominant or diagnostic symptoms or conditions. Neither does it imply that the homœopathic remedy can overcome any and all the adverse conditions and circumstances under which it may be administered. In its practice, homœopathy recognizes this principle of similarity as between the symptoms of the curative drug and the symptoms appearing in the patient. The symptoms exhibited by the patient are carefully ascertained and studied with reference to their significance and relations, and these furnish the indications upon which the selection of the «similar remedy» is then made with equal care. Whether the object of the prescriber be immediate and complete restoration to health in a curable case or mere alleviation of suffering in a case not curable, the same course is pursued.

In homœopathic practice the finding of the curative remedy is of *first* importance, as a matter of course. But the diagnosis of the case is a most urgent consideration, because it materially aids the physician in his quest for the «totality» of the symptoms, suggests his general management of the case, prompts the sanitary precautions to be taken, guides him in his prognosis, etc. Moreover, it sometimes calls to his mind a group of medicines among which the curative similimum will probably be discovered, and in this indirect way may assist in the medical treatment. Yet it must be distinctly understood that in homœopathic prescribing the final choice of the remedy is always determined, not by the name of the disease, nor even by the symptoms usually present in the disease, but only by those symptoms occurring in the individual patient. Pathology, both structural and functional, is also a subject of careful research in connection with homœopathic practice, as under other systems; but never for the purpose of formulating «theories» of the nature of the disease, on which to base treatment.

In common with all other modern «schools» of physicians, homœopathists hold that whenever the originating or «exciting» cause of the disease can be discovered it should be removed if possible. When the disease does not disappear after removal of the cause which had apparently produced it, homœopathic physicians are convinced that there must be some other contributory cause. In many cases this perpetuating cause is hidden and its nature altogether undiscoverable. They also hold the view that if this latter cause be removed the continuance of the malady is inconceivable. Equally incredible is it that the disease can be actually «cured» so long as the cause remains operative; if it could be, no matter how brilliant might seem the «cure,» it would be immediately reproduced, unless meantime the bodily susceptibility to the disease were also removed. The homœopathic profession does not concede a «cure» in any case in which the operative cause remains active, and, therefore, in the view of these practitioners, the word «cure» has a much narrower meaning, and actual cures are accomplished much less frequently than is generally supposed, the majority of such so-called cures being merely recoveries — recoveries facilitated, or perhaps made possible, by the skilful efforts of the medical practitioner — but recoveries merely.

Under this view, that the disease has a central morbific cause, it is impossible that homœopathists can accept the opinion that the malady can be cured by the mere lopping off of one or a few of its principal symptoms, or of its prominent pathological processes or conditions. How, then, do homœopathists explain their ability to reach with their remedies the perpetuating or «maintaining» cause of disease, conceding, as they do, their inability to determine its nature, or even its location? Starting out with the accepted principle that «like causes operating under like conditions produce like effects,» the homœopathist assumes the converse of the proposition to be likewise true; namely, that like results appearing under like conditions and circumstances indicate the operation of like causes. When two patients in similar conditions of health manifest similar morbid symptoms, the phenomenon is, by all pathologists, considered as indicating the operation of causes in corresponding portions of the two organisms, and acting in a similar manner. This view is not peculiar to any medical school, but is held by all physicians alike. To this doctrine the homœopathist adds the belief that it also applies to the effects of drugs, as well as to those of ordinary disease. Therefore, when similar morbid manifestations result, in one case from disease and in the other from the effects of a drug, the symptom-complex indicates a physiological or (pathological) cause operating in a similar part or parts of the organisms involved, and operating in a similar manner in both.

So much as to the *locality* of the cause,— the «seat of the disease,» upon which the «similar» drug acts. What of the *manner* in which it acts? It was long ago shown by Hahnemann and others that the effects of almost any drug upon the human body are of two kinds, primary and secondary, direct action and reaction; and that these two actions are, in a measure, the opposite, one of the other. This view has been advocated by numerous physicians, not always of the homœopathic school. Of late years the phenomenon has attracted more attention from medical writers than formerly, and is generally spoken of as «the dual action of drugs.» To illustrate: a drug may first stimulate and afterward depress a certain organ or function. Another may first depress and then stimulate, and the symptoms will, of course, take their character from the action or reaction of the drug. Some homœopathists are of the opinion that this dual quality of drug action is the proper explanation of the curative potency of the similimum. Others, Hahnemann included, explain it on other grounds. Others consider it likely that the different effects of large and small doses — a fact observed by many practitioners — may account for the cures made by the similar remedy. All homœopathists agree, however, that the question turns upon the curative *fact,* and not upon its explanation, and hold that one and all of these explanations may yet prove to be erroneous, yet firmly convinced that the main fact will remain unaffected through all changes in theory and doctrine.

Homœopathy, like any other principle or art, has its own particular field of application and operation. Thus it does not cure directly a mechanical injury to the tissues, or any impairment wrought by chemical means; though it does cure the functional diseases and disorders caused by the irritation of such injuries. The homœopathic remedy acts directly only upon function. It never alters a structure except by first modifying a function. Nor does a drug ever act homœopathically upon a function unless that function be disordered. When a drug acts on a healthy function, or when it causes disorder in a function, such action is never homœopathic, whatever may be the mode of the selection of the drug and whatever the form or quantity in which it is administered. Such, in brief, is an exposition of homœopathic belief and practice, and of its underlying principles and doctrines as taught by Hahnemann and held by the profession as a body. The small dose used by homœopathic prescribers is considered in another part of this article.

Homœopathy as a mode of medical practice is usually said to have originated in 1796, when Dr. Christian Friedrich Samuel Hahnemann published in *Hufeland's Journal,* at Jena, an 'Essay on a New Principle for Ascertaining the Curative Powers of Drugs.' In this essay he criticizes the state of the medical art, and especially urges that the chemical properties and powers of drugs are not adapted to the work of curing disease, but that cures must be accomplished by an entirely different property resident in medicinal substances. Having read of cures in medical literature and observed, in his own patients, recoveries occurring under the evident influence of the «similar» remedy, he offers the following theory of the phenomenon: «Every powerful medicinal substance produces in the human body a kind of peculiar disease; the more powerful the medicine, the more peculiar, marked and violent the disease. We should imitate nature, which sometimes cures a chronic disease by superadding another, and employ in the (especially chronic) disease we wish to cure, that medicine which is able to produce another very similar artificial disease, and the former will be cured; *similia similibus.*» Hahnemann further explains his conception of a homœopathic cure in his 'Organon,' section 26, in the following language: «A weaker dynamic affection is permanently extinguished in the living organism by a stronger one, if the latter (while differing in kind) is very similar to the former in its manifestation.» This action he designates the «homœopathic law of nature.» The term «homœopathy» or «similar disease,» as representing the new medical practice, may have been suggested, not alone by the fact of cures produced by the similar drug, but also by Hahnemann's theoretical explanation of the phenomenon.

A correct and adequate conception of homœopathy, of the difficulties necessarily encountered in its propagation and establishment, and of the place it holds and the influence it exerts in the development of therapeutics can be obtained only through knowledge of the conditions of general medicine down to the close of the 18th century. It is essential, therefore, that reference be made to certain points in the progress of medical history from its beginnings, to and including the period of the investigations that resulted in the discovery of homœopathy as a general therapeutic principle. This reference does not need to embrace all the departments of medical science — anatomy, physiology, pathology, etc.— but the department relating to treatment, or therapeutics only. It is requisite for us to know and appreciate the mental conception upon which the «art of healing» was established prior to the advent of homœopathy as a system of medical practice.

The earliest efforts of men to alleviate the sufferings caused by illness and mechanical injury were chiefly instinctive. Water, moist earth, the fleshy portions of plants and other cooling substances were employed by men, as well as by the lower animals, to mitigate the pain, heat and discomfort of local inflammation; and other simple expedients were instinctively resorted to for various disordered conditions. In time the number and variety of known remedial agents, as well as the diseases for which they were used, must have been rapidly extended by experience. And thus began the «empirical method» of treatment — the natural second step in the progress of medicine. Inefficient as were these modes of treatment, they were far more rational than most of those that occupy the pages of medical history for many succeeding centuries. These later methods were based, not on observation and experience, but upon pure assumptions having, as John Stuart Mill expresses it, «no limitations other than those of the imagination.» (The construction of medical theories, or philosophical explanations of observed facts, was a still later development). Among the large number of these ancient hypotheses are the following: (1) That disease is a punishment sent by some malevolent deity; (2) that it is due to the influence of a comet, a planetary conjunction, an earthquake or some other celestial or terrestrial phenomenon; (3) that it is caused by abnormal preponderance of some one of the four elements (fire, air, earth and water) of which the human body was said to be composed; (4) that it originates in a disturbance of the bodily states of heat, coldness, moisture and dryness; (5) that it arises from disproportion in the four humors which supply the organism — blood, mucus, black bile and yellow bile; (6) that it is produced by a *materia peccans*, or offending matter, which must needs be expelled; (7) that the body contains multitudes of «invisible pores» through which circulate infinitesimally minute atoms or corpuscles, and that disease has its cause in obstruction or relaxation of these pores; (8) that disease is based upon three possible states of the organism —«strictum,» «laxum» or «mixtum»— which must be treated with laxatives, astringents or a combination of both, as might be needed, etc. All these hypotheses, and many others, arose prior to the close of the 2d century A.D. Their absurdity is not more grotesque than that other hypothesis which underlies each and all of them, namely, that a knowledge of the cause or nature of disease necessarily indicates the means and method of its cure; a view not held at present by any homœopathic or other scientific physician. The period between the 2d century and the 15th presents little record of therapeutic art; but with the invention of the printing press came a stronger impetus to all forms of research, medical included. Since that time increasing knowledge of anatomy, chemistry, bacteriology and physiology has led to the elaboration of therapeutic theories based upon certain facts relating to these natural sciences. The advances in anatomy had suggested a mechanical basis for therapeutics; pneumatics, friction of fluids in vessels, the diameters, curvatures and angles of blood-vessels were brought forward to explain the phenomena of disease and to suggest measures for its cure. Physiology and chemistry brought out a renewal of the ancient doctrine of «four elements» and the substitution of the three «alchymistic symbols» represented by mercury, salt and sulphur, whose union is health and their separation disease. The author of this doctrine, Paracelsus, also ascribed to the «vital force» not only power, but also the intelligence, to resist disease and to provide for its cure. About the middle of the 18th century, or near the time at which the discovery of the general principle of similars was made, physiological hypotheses became largely identified with therapeutics; and the same might be said of chemical theories. Health and disease were the results of a contention between the acids and the alkalis. Haller held to the view that disease was due to change in the «irritability» of the tissues. Cullen revived an old doctrine that disease was caused by «spasm» and «atony» and required to be treated in accordance with that view. Brown, the rival of Cullen, concluded that diseases were either «sthenic» or «asthenic,» and required asthenic, or sthenic medication, as the case might be. Before the close of the 18th century the medical profession had acquired knowledge of a number of drugs possessed of «specific» properties for the cure of particular diseased conditions; among them were Peruvian bark for intermittent and other malarial fevers, mercury for syphilitic diseases, sulphur for itch, etc. These specifics exerted their curative effects by virtue of properties not at all understood at that time, and but imperfectly known a century later. These specific cures were limited to comparatively few diseases. For the treatment of the conditions with which the medical practitioner is contending daily which constitutes almost his entire duty, he depended on nothing but fallacious assumptions and hypotheses. Such was the condition of the medical art at the time Hahnemann began his independent researches in therapeutics.

Hahnemann possessed unusual linguistic attainments, which gave him access to the publications not only of Germany, but of England, France, Spain, Italy, Austria, Greece and Arabia. Not only was he a scholar in the field of letters, but he was also a practical expert in chemistry, pharmacy and industrial technology. He made many discoveries in industrial chemistry and introduced scores of improvements in the details of manufacturing chemical products. At the period of his earliest responsible connection with medicine «there was,» says Rapou, «complete anarchy in the domain of therapeutics.» Hahnemann, unwilling to trust the lives of his patients to the tender mercies of this conglomeration of assumptions, adopted the use of the class of remedies known as specifics, whose effects were easily ascertainable, though their modus operandi was altogether unknown. Homœopathy was not an invention, like some of the «systems» of medicine that preceded it; neither was it a sudden discovery. It was an evolution, its development extending over the time from 1790 to 1835, a period of 45 years. The earlier portion of the process is described by Bradford, who in speaking of its beginning says: «We now come to the translation of a very important book (Cullen's 'Materia Medica'), from which must be dated the discovery of the Law of Similars. He was translating for the booksellers and publishers of Leipzig, and it is not likely that he selected the books which he was to translate. Dr. Cullen was an authority on the subject of the materia medica of his day, an experienced lecturer, a talented chemist and a brilliant and popular teacher in Edinburgh. Naturally, the Germans wished to learn of his new and peculiar theories regarding disease, as well as to obtain the use of his 'Materia Medica,' which at this time was a standard work.

"Hahnemann was the most accomplished translator of medical works of the time, and what more natural than that the task should be given to him. Cullen published the first edition of this book, in London, in 1773. Another edition was issued in 1789, in two volumes, and it was this edition that Hahnemann used in his translation. In this book, Volume II, Cullen devotes about 20 pages to *Cortex Peruvianis* (Peruvian Bark), gives its therapeutical uses in the treatment of intermittent and remittent fevers, advises its use to prevent the chill, and gives minute directions for the safest period of the disease in which to use it. Hahnemann was impressed with the use of this drug, with which he, as a physician, had before been familiar. Something in the manner in which Cullen wrote decided Hahnemann to experiment with it upon himself and to see what effect it would have upon a person in perfect health. The result of this experiment will be given in Hahnemann's own words. In the translation of William Cullen's 'Materia Medica' (Leipzig 1790, page 108 of Vol. II), appears the following foot-note by Hahnemann: 'By combining the strongest bitters and the strongest astringents, one can obtain a compound which, in small doses, possesses much more of both these properties than the bark, and yet no specific for fever will ever come of such a compound. This the author, (Cullen) ought to have accounted for. This perhaps will not be so easily discovered for explaining to us their action in the absence of the Cinchona principle.

"'I took, by way of experiment, twice a day, four drachms of good *China*. My feet, finger ends, etc., at first became cold; I grew languid and drowsy; then my heart began to palpitate and my pulse grew hard and small; intolerable anxiety; trembling (but without cold rigor); prostration throughout all my limbs; then pulsation in my head, redness of my cheeks, thirst, and in short, all those symptoms which are characteristic of intermittent fever, made their appearance, one after the other, yet without the peculiar, chilly, shivering rigor.

"'Briefly, even those symptoms which are of regular occurrence and especially characteristic — the stupidity of mind, the kind of rigidity in all the limbs, but above all, the numb, disagreeable sensation which seems to have its seat in the periosteum, over every bone in the body — all these made their appearance. This paroxysm lasted two or three hours each time, and recurred *if I repeated this dose, not otherwise*; I discontinued it and was in health."

"The next note in the German translation is as follows: 'Had he (Cullen) found in bark traces of a power to excite an artificial antagonistic fever, he certainly would not have persisted so obstinately in his mode of explanation.'" ('Life and Letters of Dr. Samuel Hahnemann' by T. L. Bradford, M.D., pp. 35–37).

These experiments seemed to show that Peruvian bark is capable of producing in the healthy human organism a series of symptoms quite closely resembling those of that peculiar form of fever which it is known to cure. Instead, however, of solving any questions in the mind of Hahnemann it only served to suggest several others. Does Peruvian bark then produce the same symptoms that it specifically cures? If so, is this power peculiar to Peruvian bark, or is it to be discovered in other drugs? And do all drugs possess the power to cause symptoms similar to those they cure? To obtain light upon these questions occupied his efforts during the six years between the translation of Cullen's 'Materia Medica' and the publication of the 'Essay' above mentioned. To quote from a writer in the British *Homœopathic World* (1875, p. 234): "Drug after drug, specific after specific, was tested on himself and on healthy friends with one unvarying result — each remedy of recognized specific power excited a spurious disease resembling that for which it was considered specific. But many more symptoms than those diagnostic of any one disease resulted from almost every medicine, and aroused a hope in the experimenter's mind of specifically treating a greater number of diseases than had ever been so treated before. Besides discovering many valuable phenomena undreamt of, he verified his discoveries and observations by ransacking the volumes of recorded experiments in materia medica and the whole history of poisoning." The members of his family and his personal and professional friends aided in the work of experimentation, and tests of each medicine were made with different doses, and on many different persons, all the work being conducted under his own supervision.

Dr. Bradford tells us that at the time of Hahnemann's translation of Cullen's 'Materia Medica,' that is, at the beginning of his independent investigations in 1790, he had no preconceived theories or opinions to sustain. This view of his biographer is corroborated by the absence from Hahnemann's writings of even remote reference to any a priori conception or suspicion of a general curative relation between drugs and diseases. Nor does it appear that he then possessed the faintest conception of the magnitude, or of the quality, of the task he was gradually assuming. His original object evidently was to ascertain why Peruvian bark cures intermittent fever, and to learn if the view held by Cullen — that its curative property resides in a combination of bitter (tonic) and astringent qualities — was indeed true. There is no historic evidence that before 1790 the general therapeutic principle of similars had even dawned upon his mind. But we may be quite sure that the logical and philosophical principles that must necessarily govern his researches had been well thought out before the work had very far advanced.

Hahnemann and his disciples claim that in the discovery of homœopathy as a general principle of organic science, and in its conception and development as a system of medicine, assumption, speculation and hypothesis have had no place; but that observation, experimentation and inductive classification constitute the scientific and solid foundation of fact upon which it rests. They assert that all its essential doctrines are susceptible of demonstration, that they have been verified and reverified times without number, and that for the first time in the history of intellectual development the establishment of the homœopathic principle showed that the Baconian method of research is as applicable in the realm of therapeutics as in any other department of scientific investigation. If we look over the records of the processes leading to its discovery, it appears that these processes were under the guidance of the following principles of scientific philosophy, all of which are distinctly set forth by Hahnemann in his 'Organon': (1) That in the study of disease with a view to its cure, the only safe dependence is upon the manifestations (symptoms) perceptible to the senses, and that no safe conclusions can be drawn from mere theories erected upon these signs and symptoms. The signs and symptoms constitute the only side of the disease that is turned toward the physician, and the totality of these signs furnishes the only true expression or portrait of the disease; (2) that the specifically curative power of a drug resides not in its physical, nor yet in its chemical properties, but in its capacity to produce changes in the functions of the organism; (3) that the dynamic properties of a drug — in other words, its power to specifically cure disease — can be ascertained only by observing the signs and symptoms which it can produce in the organism, and that these specifically curative properties cannot be inferred from the physical or chemical properties of the drug substance; (4) that experiments for the purpose of ascertaining the pathogenetic properties (signs and symptoms) of drugs must be conducted under the precautions necessary in other researches; and the tests must be repeated and varied with a view to eliminating every influence and agency that can vitiate the experiment. The drug experimented with, and the person experimented upon, must both be "standard." That is, the drug must be pure and unmixed with any other substance capable of disguising, modifying, or otherwise affecting its own specific activity, and the person experimented upon (prover) must be possessed of good health, and free from any unhealthful occupation or habit, and from any mental, moral or other influence or agent that modify the pure effects of the drug upon his organism. Also, that the experimentation with the drug must be continued until its whole pathogenetic effect has been elicited; (5) that the observations made from such experiments as those here indicated constitute the only source of a pure and "standard" materia medica, and supply the only material from which general therapeutic principles can be discovered or deduced; (6) that effects observed from the action of a drug upon diseased persons (clinical effects) or those obtained from a combination of drugs (polypharmacy) are not "standard" effects and cannot serve as reliable guides in a search for therapeutic principles.

In the opening sections of the 'Organon,' Hahnemann mentions as among the physician's essential acquirements: (1) Knowledge of disease; (2) knowledge of the dynamic properties of drugs; (3) knowledge of the curative relations between the two. This knowledge he holds essential both to the development of therapeutic science and to enable the physician to prescribe the curative remedy. In order to qualify the physician for his work his knowledge of disease must be composed of facts perceptible to the senses. Our physiological and pathological deductions in reference to a case of disease are more or less uncertain and theoretical. Absolute knowledge of disease is limited to its signs and symptoms, besides which there can be no certain and assured foundation for a science of therapeutics. The knowledge of drug-properties must be equally certain and substantial. All drugs possess three classes of properties — physical, chemical, and specific or "dynamic." The physical and chemical properties can be ascertained by physical and chemical methods. The specific or dynamic properties, that is, the properties which alone impart the power to accomplish specific cures of disease, can be learned only by observing their power to cause changes in the health of the organism as shown by their capacity to produce signs and symptoms. Here again the signs and symptoms constitute the only sure basis of classification and induction in the construction of a science of therapeutics.

Having possessed himself of so much of such knowledge as was within his reach, Hahnemann then began the investigation of the great and dominating question: Given a knowledge of diseases as expressed by signs and symptoms, and a knowledge of drug properties as expressed by signs and symptoms, can we discover between them any general relation that will guide the physician in his search for the curative drug? In this work of "interrogating nature" he had already been led to infer what her reply might be. His experiment with Peruvian bark had given him a somewhat emphatic hint. Then followed the six years of experiments upon himself, his family and friends; with what result we have already seen. Accompanying and following came the "ransacking of the libraries" — a work for which few men were so will fitted. This literary search resulted in two important discoveries. First, that when two diseases manifesting quite similar symptoms appear in the same organism, they antagonize or annihilate each other. This subject is carefully outlined in the 'Organon' (sections 42–45) and in section 46 the writer cites a score of illustrative instances obtained from the pages of contemporaneous literature, the authority being carefully mentioned in every citation. The second result of this literary search is that it corroborates the view with which Hahnemann set out, namely, that even under the modes of treatment in vogue before his day, undoubted cures frequently resulted from the action of drugs possessed of the power to cause symptoms similar to those of the cases cured. Some of these cases are well worthy of study by these interested in medical subjects. In the earlier editions of the 'Organon' and in the 'Essay on a New Principle for Ascertaining the Curative Powers of Drugs,' these published cures are reported *in extenso,* the literary source being given, together with the name of the physician in each case. In the Dudgeon translation of the fifth German edition the same list occupies 31 pages of the appendix. In practically all of the cases reported, the mere name of the disease is sufficient to suggest the fact of similarity between the symptoms of the malady cured and the symptoms of the drug prescribed. In other cases the symptoms themselves are given with more attenion to detail than was customary at that period of medical history. If we sum up the remedies named in the 'Essay,' together with those mentioned in the 'Organon,' we have a total of 63 drugs to which Hahnemann was able to ascribe homœopathic cures occurring in the practice of physicians who had no knowledge of the homœopathic principle. In presenting this list of cases successfully treated with the similar remedy, Hahnemann had made nearly 500 citations of writers who had no suspicion that any general law of therapeutics was involved in the operation of their prescriptions. The degree of similarity shown between the pathogenetic properties of the drugs administered and the symptoms manifested by the patients seemed, in most cases, to be positive and emphatic, and in some instances striking. In what he has to say regarding the curative effects of opium this fact is graphically shown. He says: "A condition of convulsions without consciousness, resembling the death-agony, alternating with attacks of spasmodic and jerky, sometimes also sobbing and stertorous, respiration, with icy coldness of the face and body, lividity of the feet and hands and feebleness of the pulse (precisely resembling the symptoms of opium observed by Schweikert and others), was at first treated unsuccessfully by Stütz with potash, but afterward cured in a speedy, perfect and permanent manner by opium. According to Vicat, J. C. Grimm and others, opium produces an extreme and almost irresistible tendency to sleep, accompanied by profuse perspiration and delirium. This is the reason why Osthoff was afraid to administer it in an epidemic fever which exhibited similar symptoms, for the system he pursued prohibited the use of it under such circumstances. It was only after having employed in vain all the known remedies and seeing that death was imminent that he resolved to try it at all hazards and behold, it was always efficacious. J. Lind also avowed that opium removes the head troubles, and the burning sensation in the skin and the difficulty of perspiring during the pyrexia; under opium the head becomes free, the burning febrile heat disappears, the skin becomes soft, and its surface is bathed in a profuse perspiration. But Lind was not aware of the circumstance that opium produces very similar morbid symptoms in the healthy. Alston says that opium is a remedy that excites heat, notwithstanding which it certainly diminishes heat where it already exists. De la Guérène administered opium in a case of fever attended with violent headache, tension and hardness of the pulse, dryness of the skin, burning heat, and hence difficult and debilitating perspirations, constantly interrupted by the extreme restlessness of the patient. He was successful in this case because opium possesses the faculty of creating an exactly similar feverish condition in healthy persons, of which he knew nothing, though it is stated by many observers. In a fever where the patients were speechless, eyes open, limbs stiff, pulse small and intermittent, respiration labored, snoring and stertorous and deep somnolence (all of which are symptoms perfectly similar to those which opium excites), this was the only substance which C. L. Hoffman saw produce any good effects. Wirthenson, Sydenham and Marcus have in like manner cured lethargic fevers with opium. C. C. Mathai, in an obstinate case of nervous disease, where the principal symptoms were insensibility and numbness of the arms and legs, after having for a long time treated it with inappropriate remedies, at length effected a cure by opium, which, according to Stütz, Young, and others, causes similar states in an intense degree. Hufeland performed, by the use of opium, the cure of a case of lethargy of several days' duration. How is it that opium, which, as everyone knows, of all vegetable substances is the one which in its primary action (in small doses) produces the most severe and obstinate constipation, should be one of the most efficient remedies in constipation of the most dangerous character, if not by virtue of the homœopathic therapeutic law, so long unrecognized? The honest Bohn was convinced by experience that opiates were the only remedies in the colic called "miserere"; and the celebrated F. Hoffman, in the most dangerous cases of this nature, placed his sole reliance on opium combined in the anodyne liquor called after his name. Can all the "theories" contained in the 200,000 medical books which cumber the earth furnish us with a rational explanation of this and so many other similar facts? The great German physician and philosopher was careful to credit other medical men with having obtained foregleams of his great discovery. "How near," he says, "was the great truth sometimes of being apprehended!" And again, "There have been physicians here and there across whose minds this truth passed like a flash of lightning without ever giving birth to a suspicion of the homœopathic law of nature."

From Hahnemann's literary and experimental investigations alone, both he and his disciples have unhesitatingly justified their belief in a general curative relation between drugs, as represented by their symptoms, and diseases as represented by their symptoms, and their belief that this curative relation is properly set forth by the word "similarity." The proofs herein presented are considered conclusive, although similar evidence has been constantly accumulating in the writings of medical men of all schools, and in the practice of hundreds and thousands of homœopathic physicians for more than a century.

In Hahnemann's foot-note (Dudgeon's Appendix to the 'Organon,' p. 207) it is shown that he early became aware of the "danger which is to be anticipated from large doses of homœopathic remedies." He says, however, that "it often happens, from various causes which cannot always be discovered, that even very large doses of homœopathic medicines effect a cure, without doing any particular harm." In most instances homœopathic physicians come to regard the small dose as a necessity to homœopathic practice. Thus, a full dose of belladonna, or of opium, administered to a patient already suffering with symptoms like those producible by one of these drugs, might be perilous. Experience also taught them that the curative action of the homœopathic drug could be secured as well or even better through the small dose. The results claimed for these small or minute doses naturally aroused the skepticism of physicians and laymen alike, and became a serious hindrance to the spread of the homœopathic system. The very nature of the homœopathic principle, however, carries with it the necessity for the use of the diminished dose. Homœopathic physicians, when prescribing minute doses of their remedies, are under the necessity of employing great care in securing absolute purity and simplicity in the preparation of their medicines; and this has led to the need of a special pharmacy for homœopathic prescribers. Another corollary of the homœopathic law of cure is the "single remedy," without which no prescription can be strictly homœopathic. Still another principle follows from the application of this law, namely, that a homœopathic prescription can never be made from the *name* of the disease. The similarity must be traced between the symptoms of the drug and those of the individual patient. This fact is fortunate in that it at once brands the advertised "homœopathic" proprietary medicine as a fraud and a pretense, no matter in what form it may be put upon the market. The spread of homœopathy in the country of its birth, and in other countries of Europe, has been slow. The delay in securing its establishment has been due partly to the cause already mentioned — an unwillingness on the part of both physicians and laymen to accredit the little dose with curative potency. But the chief obstacle to its advancement is to be sought in inimical legislation and the lack of facilities and authority to educate young men and women for homœopathic professional life, and the consequent inability to supply the public need of homœopathic physicians. Homœopathy was introduced into the United States in 1825 by a physician named Hans B. Gram, who, at that time, settled in New York. In this country, with its free institutions and its asserted freedom of opinion, the new medical thought found less antagonism to overcome, although there were many obstacles to be encountered, chiefly of a social and legislative character. The physicians of America, less conservative, perhaps, than those of Europe, were more disposed to inquire into the scientific and practical aspects of homœopathy, with the result that in less than 20 years more than 300 of them were engaged in its practice. These physicians speedily conceived the necessity for having their own students educated under teachers of their own faith and practice, and in 1848 organized and equipped a medical college for this purpose. This school was almost immediately succeeded by others, and these institutions have very largely contributed to the rapid spread of homœopathic practice in all parts of the United States. When Dr. H. B. Gram arrived in New York in 1825, the only homœopathic literature in the English language was Hahnemann's 'Geist der homœopathischen Heilkunst,' a pamphlet of 24 pages, translated by himself and published by J. & J. Harper of New York. At the close of the first quarter-century of the new practice, more than 25,000 pages in the English language had been published by the homœopathic press, and at the end of 50 years the aggregate reached more than 150,000 pages. (Consult 'Transactions of the World's Homœopathic Convention of 1876,' Vol. II, pp. 1020–65). The progress that homœopathy has made in the United States can be best shown by the records of its organization and institutions. The American Institute of Homœopathy, the national society of homœopathic physicians, organized in 1844, now has a membership of over 3,500. There are six other national organizations, formed to promote various departments of medical and surgical interest. State societies are organized in 46 Commonwealths, and at the present rate of increase these bodies will, in a few years, exist in every State. To these may be added 150 local societies of various kinds. In the United States homœopathic physicians are in charge of 220 hospitals, general and special, 66 other institutions, asylums, homes, etc., and 65 dispensaries, 20 medical colleges and 32 medical journals.

The exact number of physicians practicing homœopathy in the United States cannot be ascertained with accuracy, but it is known to be not less than 12,000, and has been estimated as high as 18,000. The number of people employing these physicians, regularly or irregularly, cannot be less than 15,000,000. Thus has the influence of homœopathy extended during its American career of 75 years. The influence of homœopathy upon public and professional sentiment has been beneficent and pronounced. Laymen and physicians have alike learned from the practice that large quantities of potent and dangerous drugs are not often necessary to determine recovery from disease, and physicians have reached the wise conclusion that cures sometimes occur under the influence of small doses, as well as quantities with larger.

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HOMOOUSIAN, hō-mō-oo'sĭ an (Greek *homo-*, "the same," and *ousia*, "substance") and **HOMOIOUSIAN** (Greek *homoios*, "like," and *ousia*, "substance"). The Council of Nice adopted the word homoousian to express that the Son was of the same substance with the Father, while the followers of Arius adopted the term homoiousian, as a sort of middle and reconciling theory, to express that the Son, though not of the same, was yet of a similar substance with the Father. The doctrine of Arianism was not only that the Son was subordinate to the Father, but that he was totally unlike him, being a mere created being. See CHRISTIAN DOCTRINE; CREEDS AND CONFESSIONS.

HOMOPLASY, hō'mō-plăs-ĭ, the effect of the influences of convergence (q.v.), upon homologous structures. The term was proposed by E. Ray Lankester and used at first with a rather broader meaning subsequently restricted and defined by Osborn. See ANALOGY.

HOMOPTERA. See HEMIPTERA.

HOMS, hōms. See HEMS.

HONDA, Yoitsu, Japanese Methodist Episcopal bishop: b. Hirosaki, Hondo, 1848; d. 1912. He studied first at Yokohama where he accepted Christianity, and was baptized in 1872. Joining the Protestant Church, he became a member of the provincial assembly and in 1878 was ordained local elder of the Methodist Episcopal Church. From 1889–90 he attended the Drew Theological Seminary in the United States, and returning to Japan assumed the presidency of the Anglo-Japanese College of the Methodist Episcopal Church. In 1907, he was elected first bishop of the newly-organized Methodist Church of Japan. Reverend Honda was extremely active in Y. M. C. A. work, representing his nation at the World's Student Conferences in Europe several times. He was in the United States in 1910 as delegate to the M. E. Conferences, and the World's Sunday School Convention. Throughout Japanese Christendom he was recognized as an able leader and representative.

HONDO, hŏn'dō (signifying "chief island"), the largest island of Japan (q.v.), for a long time erroneously known as Nippon or Niphon, the Japanese name for the whole empire.

HONDURAS, Central American republic, bounded on the north and northeast by the Gulf of Honduras and the Caribbean Sea; on the southeast and south by Nicaragua; and on the southwest and west by the Gulf of Fonseca, Salvador and Guatemala. Estimated area, 46,250 square miles. The republic, divided into 17 departments and one territory, has as its present capital the city of Tegucigalpa, the only national capital in the new world without a railway. The number of Tegucigalpa's inhabitants was given in 1916 as 40,000. It is situated on an interior plateau about 3,200 feet above sea-level, 12 hours' journey by automobile from the nearest port, Amapala.

Mountain ranges, which rise to heights of 5,000 to 10,000 feet, are massed in the western half of the republic; the Camasca and Tompocente ranges, however, are near the frontier of Nicaragua in the east, and parallel with these and some 200 miles from the frontier is the Juticalpa Range, which stretches from the coast into the interior. Rivers emptying into the Caribbean Sea or Gulf of Honduras are the Patuca and Negro, in the east, and the Ulua in the west. The Choluteca flows southward from the Misoco Mountains near Tegucigalpa, and empties into Fonseca Bay, on the Pacific coast. Large lakes are the Caratasca on the Mosquito coast, and Yojoa, among the western mountains. The chief port on the Pacific is Amapala; other ports of entry are Omoa, Puerto Cortés (on the Gulf of Honduras), La Ceiba, Trujillo and Roatan (on Bay Islands).

History and Government.—The first place of debarkation of Christopher Columbus on the American mainland was near the present Cape Honduras, where he landed on Sunday, 14 Aug. 1502. On the following Wednesday Bartholomew Columbus landed at the mouth of the Rio Tinto. They sailed thence along the coast to Cape Gracias á Diós. The conquest of the country was effected by Hernan Cortés, who set out from Mexico City to bring to terms one of his officers, Cristóbal de Olid, who had founded Triunfo de la Cruz in Honduras, and established an independent government. The march to Honduras occupied six months and Cortés found the natives manageable, but their land "covered with awfully miry swamps," as he wrote to the Spanish monarch 3 Sept. 1526. "I can assure your majesty," he adds, "that even on the tops of the hills our horses, led as they were by hand, and without their riders, sank to their girths in the mire." (Fifth letter of Cortés to the Emperor Charles V). The natives were tractable. Without their assistance it would have been impossible to move about among the dense forests, swamps and mountains, therefore the Spaniards realized that more was to be accomplished by diplomacy than by force. Honduras became, in time, a nation of Spanish-speaking Indians; but like all the other Spanish-American colonies, it suffered from the Spanish policy which regarded the American possessions as the private estates of the Crown and as such to be exploited for the benefit of the sovereign. In 1539 Honduras became a captaincy-general of Guatemala. On its successful revolt from Spanish rule in 1521 it became part of the Mexican Empire; from which it separated in 1823 to join the Central American Confederation. In 1849 Honduras, Salvador and Nicaragua formed a political union which ended in 1863. Three years before the termination of the last effort to form a political union, Honduras was called uoon to resist (1860) the landing at Trujillo of a filibustering expedition from the United States led by William Walker. Between 1871 and 1877 the country endured both war and revolution. Comayagua ceased to be the national capital, and the government was established at Tegucigalpa in 1880. General Sierra was elected to the Presidency, 1899–1903; Gen. Manuel Bonilla, 1903–07. Honduras and Salvador were at war with Guatemala for a short time in 1906. In 1910–11 two revolutionary movements occurred, and intervention by the United States became necessary. Señor Dávila resigned the Presidency; General Bonilla, who led an armed revolt against the government, was re-elected for the term 1912–16, but died 31 March 1913. The unexpired term was filled by Francisco Bertrand, who retired from office 28 July 1915 in order to comply with the constitutional provision that no one shall assume the Presidency who has held that office at any time during the six months immediately preceding the inauguration. He was re-elected for the term 1916–20.

The first constitution of Honduras was adopted in 1848, the second in 1865, the third in 1880 and the fourth, under which the country is governed to-day, became operative 1 Jan. 1895. The usual division of authority between legislative, executive and judicial branches is followed; Congress, however, is a single body, the Chamber of Deputies, consisting of 42 members, elected by direct vote for a term of four years at the rate of one deputy for every 10,000 inhabitants. The chamber is renewed by halves every second year, and for each deputy a substitute is elected to take his place whenever necessary. All male literate citizens over 18 years of age, if married, or 21, if unmarried, "are not only entitled but are compelled" by law to vote. The President and Vice-President are elected for a term of four years by direct vote. The President is assisted by a cabinet of six ministers: Minister of Government and

Justice, of Encouragement (Fomento), Public Works and Agriculture, Foreign Relations and Public Instruction, War and Navy, Treasury and Public Credit. The judicial branch includes a Supreme Court (five justices elected by popular vote for four years); municipal courts (judges appointed by Supreme Court), and justices of the peace elected by popular vote. Title III, Art. 10 of the constitution declares that "The Republic of Honduras is a sacred refuge for every person fleeing to its territory," and by Title V, Art. 27 the death penalty is abolished. Military service is compulsory from the ages of 21 to 40. The standing army numbers 2,000, approximately, and the reserve has 54,000 officers and men. Two small vessels are placed in the care of the Minister of War and Navy, for patrol duty along the coasts.

The institutions for secondary education under public control are the National Institute of Tegucigalpa, the National College of Santa Rosa, "La Independencia" of Santa Barbara and "La Fraternidad" of Juticalpa. A school of commerce is annexed to the National Institute. Education is nominally "free and compulsory"; and facilities are actually provided at Ceiba, where schools are supported by the municipal government, and to a limited extent in poorer sections by a small tax or assessment imposed by the national government. The university at Tegucigalpa has faculties of medicine, law, political and natural sciences. A military college also forms part of the university. At Comayagua there is a school of jurisprudence. According to an official statement, "mixed" schools, attended by boys and girls together, will be established in rural districts. Provision for agricultural training has not been made on an adequate scale; the training of teachers is done in five normal schools, one in each of the departments. Freedom of worship is secured by constitutional guaranty. The government does not contribute to the support of any church, but the prevailing religion is Roman Catholicism.

National Activities.—Agriculture receives more attention than formerly. The leading product for home consumption is still maize, of which 224,844,500 pounds were raised in 1914–15, chiefly in the departments of Copán, Gracias and Santa Bárbara. Bananas are cultivated for export principally and, although the banana grows wild in nearly all parts of Honduras up to an elevation of 3,000 feet, the industry (at present the most important) of cultivating this fruit for export is confined to the hot lands along the north coast, not extending farther inland than 50 of 75 miles. The shipping-points are Puerto Cortés, La Ceiba and Trujillo, adjoining such lands. From the first mentioned port shipments average about $1,000,000 in value a year for over 1,000,000 bunches. The annual wheat crop is about 15,000 bushels; coffee, 3,860,000 pounds; rice, 4,000,000 pounds; beans, 14,030,000 pounds, and tobacco, 1,500,000 pounds. Nearly 20,000 acres are devoted to the cultivation of plantains. Cocoanuts, lemons and oranges are grown for export on a large scale. Sugar-cane is cultivated on 13,263 acres; indigo on about 9,000 acres. The total value of agricultural products annually is about $3,000,000. Honduras is essentially a cattle country. The number of cattle is estimated at 571,120; horses 68,000; mules, about 25,000. Large quantities of sarsaparilla are exported to the United States.

Prolonged drought during 1913–14 occasioned short crops and has been a calamity perhaps greater for Honduras than the European War. The total value of the republic's foreign commerce in the fiscal year 1913–14 was $10,046,261; imports, $6,624,930, and exports $3,421,331. Products exported were: Bananas, 6,610164 bunches; coffee, 1,214,454 pounds; cocoanuts, 10,366,955; hides, 805,861 pounds; deerskins, 81,791 pounds; gold and silver cyanides, 156,685 pounds. The distribution of foreign trade was: United States, $5,262,043 imports and $2,914,157 exports; Great Britain, $459,762 imports and $17,896 exports; France, $141,597 imports and $5,353 exports; Germany, $521,837 imports and $164,607 exports. Straw hats (Panama) are manufactured in the departments of Santa Bárbara and Copan, and cigars are made in different towns. Of the more than 100 factories in the republic aguardiente, soda water, sugar, soap, candles, shoes and ice constitute the principal products. Panama hats and cigars are the only manufactured exports of any great value of the republic.

Gold is found between the south and centre; silver in almost all sections. Lead, copper, saltpeter, iron, coal, zinc, nickel, platinum and antimony are also widely distributed. The value of ores produced annually is approximately $1,000,000 (20,000 ounces of gold, 1,000,000 ounces of silver and a considerable quantity of copper). Only about 5 per cent of the mines of the country are being worked. Silver, copper and lead ores are exported. The forests from sea-level to an altitude of 1,000 feet contain mahogany, ebony, dyewoods, sarsaparilla and other medicinal plants, cabinet woods and cedar. At an elevation of 1,800 feet are dense and very extensive forests of pine and similar woods.

The unit of the monetary system, which is based on the silver standard, is the peso, divided into 100 centavos and weighing 25 grammes of silver .900 fine, or say 22.500 grammes fine silver. The value of the peso of Honduras fluctuates with the rise and fall of the price of silver in the international market. Thus, it was given as about $0.42 currency of the United States in April 1916; but $0.39786, with silver at 55 cents an ounce as a basis, is the value assigned in 'Latin American Monetary Systems and Exchange Conditions' (New York 1915) and in Gonzales, V., 'Modern Foreign Exchange' (New York 1914). In March 1918, the government of Honduras entered into a contract for one year with the Banco Atlántida of La Ceiba, whereby the latter was authorized and empowered to establish agencies in the ports of the republic, the departemental capitals and in other commercial centres for the furthering of commercial affairs and the stabilization of the national currency by the storage of the silver coinage of the country as a reserve to guarantee the paper issue. Principal banks, in 1915, were the Banco de Honduras and the Banco de Comercio at the capital and the Banco Atlántida at Ceiba. The interior debt of the nation, according to the message of the President to Congress in 1915, amounted, on 31 July 1914, to 4,611,464.68 pesos. Honduras has a heavy external debt which consists principally of bonds issued for the construction of the railway from Puerto Cortés to La Pimienta and the arrears of interest thereon. The British Council for Foreign Bondholders represents the holders of these bonds. The amount of the external debt was given (1 Jan. 1914) as £23,693,969, of which £18,295,399 represented arrears of interest. In other words, a debt of less than $26,000,000 (in 1870), increased to $120,000,000, approximately, by 1917. The budget for 1915–16 estimated receipts at 5,929,420 pesos, and the value of the peso at that time was approximately 36.15 cents, currency of the United States.

The National Railway extends from Puerto Cortés to Pimienta, 56 miles. Privately owned lines in the banana regions aggregate about 109 miles. The Ulua River is navigable for a distance of 125 miles, and other streams facilitate, to a limited extent, communication between the north coast and the interior. On that coast, service with Puerto Cortés (and occasionally Ceiba, Trujillo and Tela) is maintained by steamers from New Orleans, New York and Mobile. On the Pacific coast dependence is placed upon the San Francisco-Panama steamship lines. There are 278 post offices. The number of letters (both internal and foreign correspondence) is not more than 1,550,000 in a year. The republic has 4,281 miles of telegraph wire; the capital and some other towns telephone services.

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MARRION WILCOX.

HONDURAS, British, or Belize, a crown colony in Central America, south of Yucatan, and 660 miles west from Jamaica. It is bounded on the north and northwest by Mexico (Yucatan), on the east by the Caribbean Sea and Gulf of Honduras and on the south and west by Guatemala.

Area, Physiography, etc.— Its area is 8,598 square miles, including numerous cays. The coast is generally low and swampy and the interior is largely covered with forests of logwood, pine and mahogany. The Cockscomb Mountains in the southern district rise to the height of 3,700 feet; the northern part contains many lagoons. The climate is hot and moist and, generally speaking, is unhealthful for Europeans. About 50,000 acres are under cultivation and produce fruits, coffee, rubber, etc.

Commerce.— The total value of the imports in 1916 was $2,690,306, a gain of $561,303 over the previous year, due principally to the increased price of nearly every article invoiced. The United States supplied goods worth $1,583,650; Great Britain, $430,345; British colonies, $30,359; and other countries, $645,952, consisting chiefly of chicle from Guatemala ($263,760) and Mexico ($169,673) in transit to the United States.

The principal articles imported in 1916 from the United States were: flour, $162,343; boots and shoes, $119,895; fruits and vegetables, $73,360; miscellaneous foodstuffs, $51,970; lard and compounds, $56,956; hardware and cutlery, $46,237; drugs and chemicals, $38,032; condensed milk, $48,125; wearing apparel, $69,134; piece goods, cotton and silk, $107,707. The total exports from the colony in 1916 were valued at $2,543,622, of which $1,392,836 went to the United States; more than half of the remainder, $1,150,786, represented products and manufactures of other countries in transit through the colony. The value of the principal exports to the United States in 1916 was: mahogany, $473,548; chicle, crude and dried, $330,045; bananas, $259,410; cocoanuts, $154,290; logwood, $94,519. Exports to the United States in 1915 totaled $1,850,000 and to the United Kingdom, $311,200. Tonnage entered and cleared in 1915 amounted to 803,181 tons, of which 91,370 was British. Registered shipping in 1914 consisted of 298 sailing vessels of 4,531 tons and 53 steamers of 1,981 tons.

Government, Finances, etc.— The colony is administered by a governor, who is also commander-in-chief, assisted by an executive council of six members, and a legislative council consisting of five official and seven unofficial members. The chief sources of revenue are the customs duties ($291,450 in 1914–15); excise, licenses, land-tax, etc., also the sale and letting of Crown lands. The total revenue is about $550,000 annually. The expenditure, mainly administrative and for the various services, reached $614,175 in 1915, in which year the public debt was $972,705. Banking facilities are furnished by a branch of the Royal Bank of Canada. There are six government savings banks, which had, on 31 Dec. 1915, $104,313 on deposit credited to 932 depositors. United States gold is the standard of currency. The British sovereign and half-sovereign are legal tender for $4.86 and $2.43 respectively. There is a paper currency of $197,825 in government notes and a subsidiary silver coinage of $158,917 in circulation. There is also a bronze cent piece and a nickel-bronze five-cent piece, whose issues amount to $5,750 and $2,500 respectively.

Post Office, Communications.— In 1915, 356,000 letters and post-cards, and 166,000 books, newspapers and parcels passed through the post office. The Belize River forms the chief highway from the coast to the western and southwestern parts of the colony. It is navigable for light-draft motor and cargo boats for a distance of more than 100 miles. The rates for both passengers and freight are high, but most of the traffic to and from the interior is carried over this route. There is only one railway in the colony, from Stann Creek to the interior, about 25 miles. It has a gauge of three feet and was built by the government at a cost of $826,250. The British Honduras Syndicate has a tram line running eight and three-quarter miles from the Stann Creek pier inland beyond Melinda and another about three miles long connecting the Sennis and the Monkey rivers. The trams are used chiefly for the transportation of bananas. Telegraph and telephone lines connect Belize with Corozal, Consejo and other stations in the north, El Cayo in the west and Punta Gorda in the south. Foreign telegrams are sent from Corozal to Payo Obispo, Yucatan, whence they are transmitted by the Mexican line. The wireless telegraph station at Belize was completed in 1915 and affords communication, through other systems, with the United States. A station of the United States Weather Bureau was established at Belize in November 1916. Steamship communication between Belize and New Orleans is afforded by the regular weekly mail service of the United Fruit Company, which also maintains a fortnightly service to and from New York.

Education.— In 1915 there were in operation 54 primary schools, with 5,528 enrolled children, and an average attendance of 1,912; in addition there were 6 primary schools, with 230 in average attendance, which received no government aid. The government spent $23,300 on primary education in 1915. There are five schools with secondary departments with altogether about 350 pupils. They are under denominational management and none receive aid from the government.

Population.— In 1911 there were 20,374 males and 20,084 females, a total of 40,458. The population of the colony at the end of 1916 was estimated at 42,323. The whites number about 650, the rest consisting of negroes, mulattoes and Indians. The birth-rate per 1,000 was 40.1 in 1915, and the death-rate 26.2. Belize, the chief town and seaport, had a population of 10,478 in 1911.

For the origin and early history of the colony, see BELIZE; also CENTRAL AMERICA.

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HONDURAS, Gulf of, spacious inlet of the Caribbean Sea, having on the west British Honduras and on the south Guatemala and Honduras. In it several smaller bays of which the Gulf of Amatique, with its inner recess, the bay of Saint Thomas, are spacious and deep. Several large rivers, the Belize, Chamelicon, Dulce, Motagua and Ulua, flow into the gulf. Along the shores are the islands of Turneffe, Manabique, the Bay Islands including Ruatan, Utila and Bonacca and numerous islets and reefs called cays.

HONE, hōn, **Philip,** American merchant: b. New York, 1781; d. there, 4 May 1851. He was a successful auctioneer in New York, established there the first savings bank (1816), was mayor in 1826 and one of the founders of the Mercantile Library Association. Prominent in national political affairs, he aided in the formation of the Whig party. His diary, a portion of which, edited by Tuckerman, appeared in 1889, contains important sidelights on the early history of the Whigs. Hone was also at one time naval officer of New York port.

HONE, William, English bookseller and author: b. Bath, 1780; d. Tottenham, 1842. He was sent to study law, but his preferences led him to undertake the business of bookselling. He was well known in his day for his parodies and satires on religious and political subjects, of which the most notorious were 'Political Litany' (1817); and the 'Political House that Jack Built' (1819). Of greater literary value are 'Ancient Mysteries' (1823); 'Every-Day Book' (1826–27); 'Table Talk' (1827–28); 'The Year Book' (1832). A representative collection of his works is to be found in Tegg, 'Every Day Book, Table Talk and Year Book' (1873); and 'The Three Trials' (1876), containing an account of his acquittal at the trials which he had to undergo for railing against the government. His autobiography, 'Early Life and Conversion of William Hone, by Himself' was edited by his son (London 1841).

HONE, a strop or stone for sharpening knives and razors. See WHETSTONE.

HONESDALE, hōnz'dāl, Pa., borough, county-seat of Wayne County, on the Lackawaxen River; the Erie and the Delaware and Hudson railroads; about 15 miles northeast of Carbondale and 30 miles northeast of Scranton. The first locomotive used in America, the "Stourbridge Lion," made its trial trip from this city. It is situated in a coal-mining region, with good farming land in the valleys. Its manufactures are silk and woolen goods, boots and shoes, machine-shop and foundry products, axes, concrete blocks, paints, electric elevators, green, cut, engraved and decorated glassware, men's clothing and wheels for polishing glass. Large quantities of coal are shipped annually from Honesdale. Pop. 2,945.

HONESTY. A flowering herb. See SATIN-FLOWER.

HONEY, a sweet sticky liquid obtained by bees and other insects from flowers (see HONEY-BEE; and FLOWERS AND INSECTS) as food, or taken home to be stored as food for the young. The care with which the honey-bee (q.v.) collects and stores this substance in its hive has led to bee-culture (q.v.). Honey is highly nutritive, especially as a fuel for the energies of the body, as four-fifths of its components are carbohydrates, the remainder being water with a trifle of protein. The saccharine elements are mainly grape-sugar and some fruit-sugar, which are so readily affected by yeast that various fermented drinks are made with honey as their basis, of which the best known are the mead and metheglin in great demand among all Teutonic peoples a thousand years ago, and the equivalents of which are still made in Russia, Abyssinia and elsewhere. Before the general manufacture and use of cane-sugar, honey was largely depended upon for purposes of sweetening, and was put into a great number of cakes and confections now rare or only locally manufactured. Of the place which it took among the ancients in the household, in ceremonials, worship and for lore a large amount of curious information may be gathered from such books as Beckman's 'History of Invention' (1846); Dutt's 'Materia Medica of the Hindoos' (1877), and similar works, of which lists may be found in Warring's 'Bibliography of Therapeutics' (1868), and in the 'Catalogue of the United States Army Medical Museum.' The importance of honey was, indeed, much greater to the ancients than to us; as might be inferred from its frequent mention in the Bible as a sign of abundance or the resource of the destitute. It has well-recognized medicinal properties, especially as a demulcent against hoarseness, catarrh, etc., in promoting expectoration in disorders of the breast and as an ingredient in cooling and detergent gargles. Its effect is usually laxative also. It is used to sweeten certain medicines; and is sometimes mixed with vinegar in the proportion of two pounds of clarified honey to one pint of the acetic acid, boiled down to a proper consistence over a slow fire, and thus forms the oxymel simple of the shops. It enters into the composition of various sweetmeats, as in the East, such as the genuine Oriental nougat. Its use in confections in the United States was considerably increased as a result of sugar shortage in 1917 and 1918 and the importation has become a considerable business. The properties and the flavor and color of honey vary with the qualities of the flowers from which it is made. Thus in Europe the white Narbonne honey of France is said to owe its peculiar and delicious flavor to the rosemary and other labiate flowers on which the bees feed. The Grecian honey also stands in high estimation. Mount Hymettus in Attica has been famous since classic times for this product; but that yielded by the bees who range the thyme-covered hills of Corinth is said to excel it. Another famous ancient source of supply was Sicily, especially about Mount Hybla; and Corsica is yet celebrated for its honey and wax, which in ancient times were the chief exports of that island. In the eastern United States the early light-colored honey obtained from the blossoms of the white clover is especially esteemed; also that derived from raspberry plantations, bass-wood flowers and the like; while that made later in the summer from buckwheat is in favor among darker varieties. California is an extensive producer of honey from various flowers.

As the aromatic agreeable flavors and healthful qualities of special flowers (fortunately in the majority) are kept and apparent in ordinary good honey, so certain bad qualities are retained and spoil some honey, which thereby becomes deleterious to the human system, acting as a nauseant, a purgative, affecting the nerve-centres or even seriously poisoning those who eat it. This is the case in the United States with honey made from the flowers of the mountain laurel (*Kalmia*) and some other toxic plants. Some persons are unable to eat any kind of honey, without disarrangement of the digestion or nerves, or both; and all should use it in moderation.

The industry of bee-keeping is for the purpose of supplying the market demand for honey. Modern hives are so constructed that the bees build separate combs each filling a box with glass sides, which are taken out and sent to market as the bees finish them. Another method of marketing is in the form of "strained" honey, the liquid pressed from the comb after warming, through sieves of linen cloth, or by other means. There is no reason why this should not be as good as that left in the comb, if properly prepared and preserved, and it permits of saving the material of the combs for wax (q.v.); but it makes possible adulteration, which is freely taken advantage of. The chief adulterant is commercial glucose, which occasionally is substituted to the extent of three-fourths of the volume, leaving only enough real honey to flavor the mass. As glucose (grape-sugar) is a large constituent of this substance in nature no great harm results (when the glucose is good), beyond the deception; and wholly artificial honey has been largely sold in the past as the product of bees. Consult Simmins, 'A Modern Bee Farm'; *Bee-Keepers' Record.* See BEES.

HONEY ANT, a true ant of the family *Formicidæ*, and chiefly of the sub-family *Camponotinæ*. The honey ant (*Myrmecocystus melliger*) is so called from certain of the wingless individuals becoming so many honey-pots; their abdomens being distended with honey fed to them by the normal workers, including both dwarfs and majors. It occurs from central Colorado (Garden of the Gods) to New Mexico and as far south as the City of Mexico. It erects mounds six or seven inches across and two or three inches in height, of the shape of a truncated cone. In the interior is the "honey chamber" or a rough dome-roofed vault or fissure, the honey-bearers (600 in a large colony) clinging by their feet to the roof. Their yellow bodies are stretched along the ceiling, their swollen, round, amber-colored abdomens of the size of currants hanging down. The "honey" is obtained in the night time by the workers which go in long processions to some distant scrub-oak bearing nectar-producing galls. The workers return with distended abdomens, and feed the honey-bearers with the nectar. C. McCook thinks the honey-bearers are not a distinct caste, but simply workers "with an overgrown abdomen." The honey is thus stored, as bees store their honey, for food in winter or times of famine. A similar habit has been acquired by various related kinds of ants in the dry plains and deserts of Mexico (where these ants are dug up by the people and utilized as a regular food-supply) and in South Africa and central Australia. Consult McCook, 'The Honey Ants of the Garden of the Gods,' etc. (Philadelphia 1882); Wheeler, 'Ants' (New York 1910).

HONEY-BADGER, a small muste line burrowing animal (*Mellivora indica*) of India, which eats insects, frogs, birds' eggs and small animals generally, and is fond of honey. The natives believe it robs graves, but destruction of poultry is its worst sin. It is nearly related to the South African ratel.

HONEY-BALL, or GLOBE-FLOWER. See BUTTON-BUSH.

HONEY BEAR, the sun-bear (q.v.).

HONEY-BEE. Bees in general are *Hymenaptera*, of the family *Apidæ*. Bees are distinguished from wasps and other hymenoptera in the first place by the long, broad, flattened basal joint of the hind tarsus, which is adapted for carrying pollen to the nest. Bees are also more hairy than others of their order, and some of the hairs are plumose or feathery. The mouth-appendages are long and highly specialized, especially the long flexible proboscis or tongue (hypopharynx). There are no wingless adult forms. While the more primitive genera are solitary, in the more specialized or social kinds, besides the males and females, there are workers, which are, as a rule, sterile females in which the ovaries are undeveloped. Of the bee family there are now known to be about 150 genera and 1,500 species.

Original Home of the Honey-bee.—Although the honey-bee (*Apis mellifica*) has followed the white man in his migrations from the Old World to the New, and to Australia, New Zealand, etc., its original birthplace is in southern Asia, probably including the eastern shores of the Mediterranean Sea. Besides *A. mellifica* there are seven or eight other species, all except one southern and eastern Asiatic, including the islands of Timor and Celebes; the exceptional one (*A. adamsoni*) inhabiting tropical Africa and Madagascar. We know little of the honey-bees of China and Japan.

Like other domestic animals (and the honey-bee is the only domestic insect we possess), this bee is divided into races of which the Ligurian bee (variety *ligustica*), originally inhabiting Italy and adjoining regions, is a well-marked one, and another is the Egyptian honey-bee (variety *fasciata*). There are several subvarieties of the northern form of *A. mellifica* in Germany. The English naturalist Ray, who published before Linné, gave the name *A. domestica* to the northern dark form, our common honey-bee. This dark, northern form is the one which has been carried by the European race to various parts of the world, in some of which it is now wild. It occurs in the West Indies, in North America, including Mexico, in central and southern Africa and in Australia and New Zealand. The variety *ligustica* has also been found at the Cape of Good Hope.

Besides the honey-bee there are other social forms in Central and South America, as well as other tropical countries, including Australia, which store up honey; these are small bees, exceedingly numerous in individuals, which belong to the genera *Melipona* and *Trigona*, and are stingless, though the sting exist in a rudimentary state. *Trigona mosquito* is known to send off swarms and to have but a single queen in a colony. The nests are built in hollow trunks of trees, in banks of clay or earth, and they gather pollen, nectar and resin. On the whole, the honey-bee stands at the head of the hymenopterous series, and, in fact, at the head of the class of insects, though the house-fly is in some respects more extremely specialized.

Structure of the Honey-bee.— Besides the males or drones, and the female or queen, the colony consists of workers; these carry on the work of the society, gathering nectar, pollen, building the cells and feeding the young. The colony is permanent, differing in this respect from that of bumblebees, which come to an end each autumn. We will first describe the chief points in the external anatomy of the insect. The body is divided into three regions, the head, thorax and abdomen. The eyes are of two kinds, simple and compound, the male differing from the queen and the workers in the large compound eye meeting in the middle of the top of the head. The mouth-appendages consist of three pairs,— first the jaws or mandibles; these in the queen and drone are notched, but in the worker the edge is entire and serves for biting, and in comb-building for thinning out wax shreds, also for scooping and molding the wax, while the next pair of appendages, or accessory jaws, are called maxillæ, and are used as a trowel. In the bumblebee the maxillæ are also used for piercing the corolla of flowers like the wistaria and honeysuckle, but those of the honey-bee appear to be too weak for this purpose. They also ensheathe the proboscis. The so-called tongue (ligula, lingua or hypopharynx) is the long, slender, hairy appendage adapted for gathering the nectar of flowers. It is an outgrowth of the under lips (labium or fused second maxillæ), is situated in a tube formed by the maxillæ and labial palpi, and can be partially withdrawn into the mentum, or base of the under lip. It can move up and down in the tube thus formed. It is covered by a hairy sheath, and is very elastic, this being due to a rod extending through its centre, enabling it to be used as a lapping tongue. Cheshire states that the rod on the under side has a gutter or trough-like hollow, which forms a false tube by the intercrossing of black hairs. There are also two side-ducts, which extend along to the end of the tongue, where the «spoon» or «bouton» is situated. This is provided with very delicate split hairs, «capable of brushing up the most minute quantity of nectar, which by capillarity is at once transferred by the gathering hairs to two side groove-like furrows at the back of the bouton.» The central duct, because of its smaller size and consequent greater capillary attraction, receives the nectar, if insufficient in quantity to fill the side ducts. «But,» says Cheshire, «good honey-yielding plants would bring both centre and side into requisition. The nectar is sucked up until it reaches the paraglossæ, which are plate-like in front, but membranous extensions, like small aprons, behind; and by these the nectar reaches the front of the tongue, to be swallowed as before described. The process of gathering the nectar is not exactly either a sucking or a licking process; but, as Cheshire shows, the action is primarily due to capillary attraction.

Organs of Smell and Taste.— Bees are guided to flowers chiefly by smell, rather than by the color of the flowers they visit. (See Flowers and Insects). The olfactory organs are multitudes of microscopic pits in the antennæ — the organs of smell. The sense of taste is lodged in a minute soft baggy fold on the under side of the upper lip, which is rich in taste-cups; and, besides, there are a few taste-papillæ or cups found by Packard at the base of the paraglossæ and on the base of the labial palpi. These sites of the gustatory organs are situated where the food or nectar will come in contact in passing down the throat into the stomach.

Formation of Honey and the Honey-Stomach.— In insects there is the fore stomach (proventriculus) and the true or chyle-stomach. The former is called by apiarians the «honey-sac» or «honey-stomach.» «If,» says Cheshire, «it be carefully removed from a freshly killed bee, its calyx-like ‘stomach-mouth’ may be seen to gape open and shut with a rapid snapping movement.” The entrance to the stomach is guarded by four valves, which open to allow the passage of food from the honey-sac to the chyle-stomach. It is closed at will by circular muscles. Thus the bee can carry food for a week's necessities, either using it rapidly in the production of wax, or eking it out if the weather is unfavorable for the gathering of a new store. By means of a complicated mechanism a bee in sucking up, from composite and other flowers, nectar together with much pollen (1) can either eat or drink from the mixed diet she carries, gulping down the pollen in pellets, or swallowing the nectar as her necessities demand; (2) when the collected pollen is driven into the chyle-stomach, the tube-extension prevents the pellets forming into plug-like masses just below, for by its action these pellets are delivered into the midst of the fluids of the stomach to be at once broken up and digested; (3) “while the little gatherer,” says Cheshire, “is flying from flower to flower, her stomach-mouth is busy in separating pollen from nectar, so that the latter may be less liable to fermentation and better suited to winter consumption. She, in fact, carries with her, and at once puts into operation, the most ancient, and yet the most perfect and beautiful, of all honey-strainers.”

How the Honey is Made.— Honey is made of nectar, and is due to a chemical change in the honey-sac. The bee gathers the nectar with its “tongue,” swallows it; it then passes into the honey-sac, and is regurgitated as honey. The nectar when gathered is almost entirely pure saccharose, and according to Bertrand, when regurgitated it is found to consist of dextrose and levulose; this change appears to be practically the conversion of cane-sugar into grape-sugar. A little salivary fluid is poured out into the mouth as the bee sucks the nectar, and this effects the chemical change. Cheshire thinks that the salivary fluid is added while the nectar is being sucked, and is passing over the middle parts of the under lip, so that the nectar may be honey when swallowed by the bee.

Many and probably all bees eat the pollen while gathering it. The plumose hairs of bees are of use in collecting the pollen grains which adhere to them, but the exact method of accumulation of the pollen and the mechanism of its conveyance from hair to hair till it reaches the part of the body it must attain in order to be removed for packing in the cells is not fully understood, but the head and front legs scratch up the pollen-grains, and the honey-bee has a pollen-basket on each hind leg, the basal joint of the tarsus being broad and slightly hollow, with nine rows of short hairs to which the pollen-grains adhere.

Life History and Social Life.— In founding a new colony the young swarms consist of a queen-bee and a number of workers, a surplus population of the old colony. The swarming is not a nuptial flight, but an act of emigration. After the new swarm has been housed, the workers begin their labors by secreting wax. This is formed in glands on the inside of the ventral plates of the abdominal segments, appearing outside as thin projecting plates, which are removed by the wax-pincers on the hind legs; after being molded by the jaws they form the hexagonal cells in which the young or larvæ live and the food is stored, and thus the comb is gradually built up. The queen then lays an egg in each cell, and the larvæ (grubs) on hatching are fed by the workers. This they do by eating honey and pollen, which is formed in the digestive organs, into a kind of pap. This pap looks like arrowroot made with water, and the very young grubs partly float in it, besides absorbing it by the mouth. The young grubs, as they increase in size, are weaned from this glandular secretion or pap, pollen, honey and water being added, while the pap or glandular secretion is gradually withdrawn. The queen larvæ, according to Cheshire, is not weaned, but the secretion or pap (the so-called “royal jelly”), which is a rich, highly nitrogenous food, is added unstintingly to the end, and owing to this the queen becomes larger and fertile. When the colony is progressing well and young bees emerge, these act as nurses, the old ones going out of the hive to forage. When the grub is full-sized the worker bees seal up the cell with a cover made of pollen and wax, but pervious to the air. In this cell the grub spins a cocoon in which it pupates, finally biting its way out; the bee developing in three weeks from the time the egg is laid.

The new queen arises from an egg laid in the royal cell, which is large and slipper-shaped. She develops in 16 days. Only one queen is allowed in the hive at one time. The males (drones) arise from unfertilized eggs. The drone cells are a little larger than the ordinary worker cells. A drone is developed in about 24 days. When a swarm leaves the hive the old queen quits with it, but when a second swarm goes off from a hive it is accompanied by a young queen, who is frequently, and perhaps usually, unfertilized.

The young queens will usually mate when five to seven days old, flying from the hive for this purpose. In a day or two after mating the queen generally begins to deposit eggs, and is then ready for use in the hive or to be sent away as an “untested queen.”

Bee-Culture.— Spring is the best season to start a hive or apiary. In April a good colony situated in the Central States ought to have brood in five or six combs. The Langstroth hive with its modern improvements is the best, and the novice should select those holding 10 to 12 frames in each story.

Swarming is the result of an abundant secretion of honey, and combs crowded with bees and brood, that is, overpopulation. Just before swarming there is a partial cessation of field-work, the workers clustering or loitering about the entrance to the hives. Suddenly those which happen to be in the hive at this time rush forth, accompanied by the old queen, and cluster on some tree or shrub near by. Hiving the new swarm can be done after a little experience and the use of smoke. Swarming may be prevented by giving abundant room for the storage of honey early in the season, before, as Benton says, the bees get fairly into the swarming notion. The honey also should be frequently removed. Also the hives should be well ventilated and shaded in hot weather. To successfully winter bees the colony must have a good queen, and young workers, also good and abundant food. Those colonies having the most honey compactly stored in the brood department and close about the very centre when the last brood of young bees should emerge, are the ones which will winter best. A good substitute for honey is a syrup made of granulated sugar, to be fed early in autumn. The bees should be kept dry and warm, and there should be no manipulation out of season. (Benton).

Diseases and Enemies.— Diarrhœa is due to sour or fermented honey, dampness, and chilling of the bees. Foul-brood is a germ-disease, occasioned by *Bacillus alvei*; it affects both the brood and the adult bees. Of insect enemies the caterpillar of the wax or bee-moth is the most destructive, but with care it can be kept out of well-regulated hives.

Agency of Bees in Cross-Fertilization of Plants.—A hive is an essential thing in an orchard, and were it not for the visits of bees the fruit in many cases would not set. Also in hothouses where cucumbers are raised, a small hive of bees is indispensable for fertilizing the flowers. See Bee-keeping; Flowers and Insects.

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HONEY-BIRD, or HONEY-GUIDE. See Guide-birds.

HONEY BLOOM, one of the American species (*Apocynum androsæmifolium*), the «spreading dogbane» of the family *Apocynaceæ* (q.v.). It grows in fields and thickets all over temperate North America, and has the medicinal qualities characteristic of the family.

HONEY-BUZZARDS, a genus (*Pernis*) of Old World hawks, formerly called «perns,» which subsist mainly on insects, especially burrowing wasps, and bees, with their young and food-stores, which they dig out of the ground.

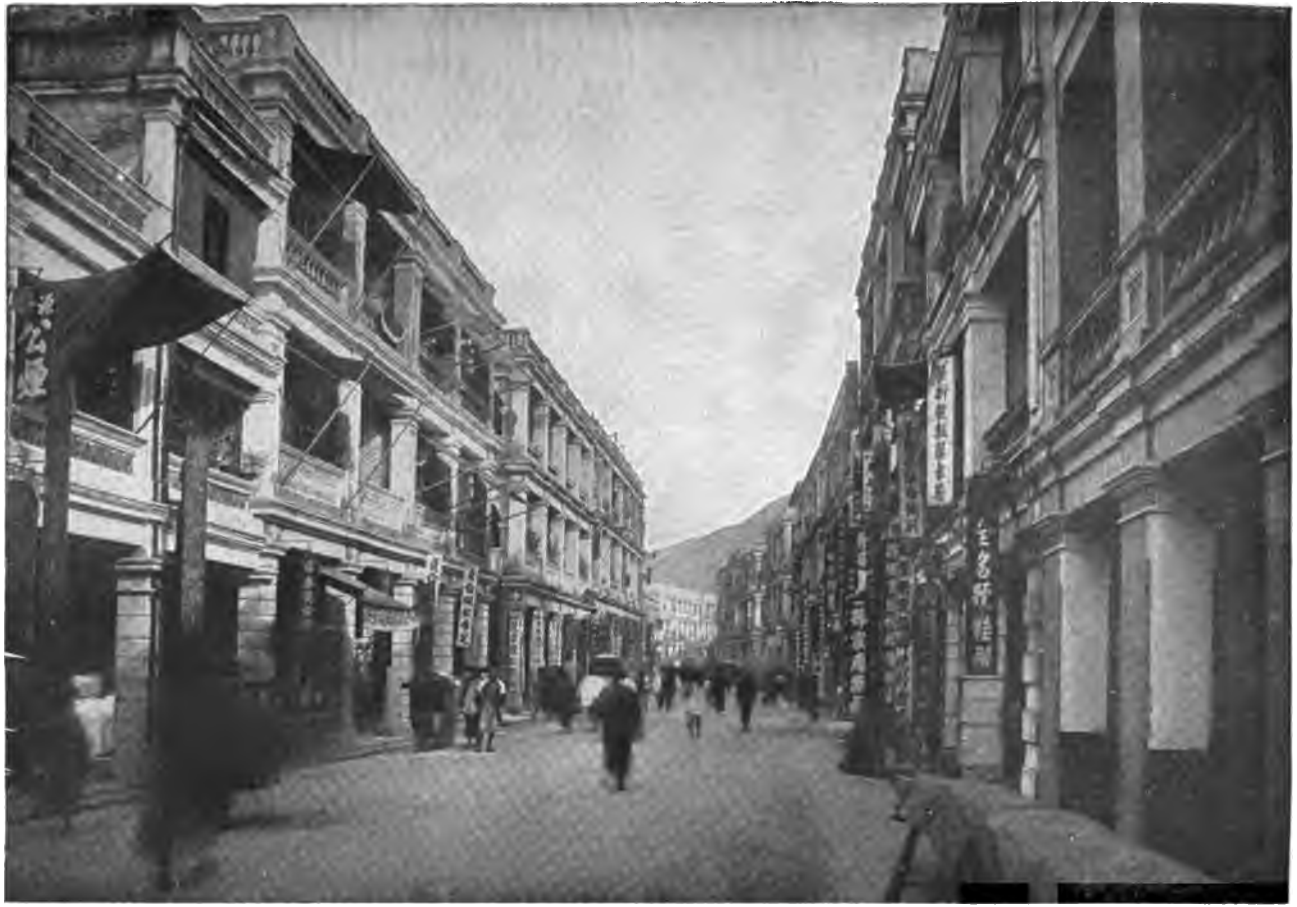
HONEY-CREEPERS, a group of small warbler-like birds (the family *Cærebidæ*) of gay plumage, numerous in the West Indies and neighboring lands, where they are known as «quits,» «banana-birds,» etc., and are common about gardens and plantations and admired for their agility in searching flowers for small insects, and their cheery notes. They render an important service in the cross-fertilization of the trees and plants they frequent, by carrying pollen on their feathers from one flower to another. See Birds, Fertilization of Flowers by. Among them are the «banana-birds» (q.v.).

HONEY-DEW, the sweet secretion of certain plants and insects. (1) Some trees in warm climates yield from their leaves in very warm, moist weather a saccharine liquid which may fall in drops, or may form a sticky film over each leaf. This exudation, dried, is one form of manna. (2) Certain minute insects, chiefly plant-lice, leaf-hoppers and related bugs, yield a sweetish secretion, sometimes so copiously as to bedew a whole tree, and even fall in drops, giving the phenomena called weeping trees. The usual cause in this case is the presence of a tree-hopper (*Proconia undata*). Honey-dew in both cases attracts insects in large numbers, who feed upon it or upon the lesser insects gathered to the feast; and these, in turn, attract larger predatory animals, as birds, lizards, etc. Moreover dust sticks to it, closing the pores of the leaves to the injury of the tree; and, still worse, the honey-dew forms a highly favorable culture-ground for the spores of smuts and other pernicious fungi.

HONEY-EATER, or HONEY-SUCKER, any of various small and somewhat thrush-like long-billed birds of the family *Meliphagidæ*, which inhabit the Australian regions, and seem to feed upon the nectar of flowers. They do so to some extent, but mainly are in search of insects within the corolla, collecting them easily by means of a peculiar tongue, which is divided near the end into a sort of fringe. They also eat soft fruit, and spend much of their time hunting insects on the ground. Well-known examples are the soldier-bird, parson-bird, pimlico, friar-bird and others familiar in Australia and New Zealand.

HONEY-GUIDES. See Guide-birds.

HONEY HILL, Battle of. On the night of 28 Nov. 1864, General Foster, commanding the Federal troops in the Department of the South, left Hilton Head, S. C., with 5,000 infantry, cavalry and artillery, and about 500 sailors and marines, for Boyd's Neck on the south side of Broad River, the object of the movement being to cut the railroad connecting Savannah and Charleston and otherwise co-operate with Sherman, who was marching to the coast. Owing to a thick fog many of the boats lost their way and it was late in the afternoon of the 29th before the troops got ashore. General Hatch was put in command, with orders to push forward and cut the railroad. Hatch marched immediately; the guides and maps proved worthless, and, after marching and countermarching the greater part of the night, he went into bivouac about 2 o'clock on the morning of the 30th. Information of Foster's appearance at Boyd's Neck was carried to General Hardee at Savannah on the evening of the 29th, and next morning at 2 o'clock, the advance of G. W. Smith's Georgia militia arriving at Savannah, Hardee directed Smith to hasten it to Grahamsville Station on the Charleston and Savannah Railroad. The station was reached at 8 A.M., and the men marched out on the road leading to Broad River landing, about three miles, where, on the crest of the north bank of a small stream, a work for light guns had been thrown up and trenches for infantry prepared. These works were about 100 yards from the little stream and upon Honey Hill, 10 or 12 feet above the water level. On the right of the battery of five guns was a dense forest, on the left an open pine wood. The ground in front was open. Preparations were completed by 10 o'clock, at which hour about 1,000 militia filled the trenches on the right and left of the battery. Early in his



Courtesy of the Philadelphia Commercial Museums

QUEEN STREET, HONGKONG

march Hatch encountered the Confederate outposts, drove them in and soon after 10 o'clock came under fire of the guns. Hatch attempted a flanking movement, but failed, and made several direct assaults during the day, all of which were repulsed, and at dusk he began his retreat to Boyd's Neck. His loss was 711 killed and wounded and 43 missing. During the action Smith was reinforced by the 47th Georgia, but at no time did he have more than 1,400 men. He lost 8 killed and 42 wounded. Consult 'Official Records' (Vol. XLIV).

HONEY-LOCUST, or **HONEY-SHUCKS.** See LOCUST TREE.

HONEY-SWEET. See MEADOW-SWEET.

HONEYSUCKLE, a genus of plants, *Lonicera,* belonging to the family *Caprifoliaceæ.* About 175 species are native to the northern hemisphere. The genus is represented in the North American flora by different species, among which are *L. sempervirens,* the trumpet honeysuckle; *L. caprifolium,* American woodbine, an introduced species; *L. flava,* yellow honeysuckle, etc. "Coral honeysuckle" is another name in the United States for *L. sempervirens.* It is much valued in the South, where it is native, for its flowers of beautiful color and sweet perfume. In the eastern United States the Japanese honeysuckle has escaped from cultivation. The common honeysuckle, *L. periclymenum,* with distinct leaves and red berries, is indigenous in Europe. There are many other species in America, Europe and Asia, and the name honeysuckle is often given to shrubs with sweet flowers of quite different genera.

HONGKONG, hŏng'-kŏng', or **HIAN-KIANG,** hē'ăn-kē'ăng (signifying "the place of sweet streams"), an island off the southeast coast of China, forming with Kau-lung on the mainland a British Crown colony and naval station. The island is on the east side of the estuary of the Chu-Kiang or Canton River, 90 miles south of Canton, and is separated from the mainland by the narrow Lyemun Strait. About 10 miles long and from two to five miles broad, the island is of rocky formation, attaining in Victoria Peak a maximum altitude of 1,809 feet. Its area is rather more than 32 square miles. By the Convention of Pekin, signed 9 June 1898, China leased to Great Britain for 99 years a portion of her territory, mainly agricultural, together with the waters of Mirs Bay and Deep Bay and the island of Lan-Tao. Its area is 356 square miles, with about 91,000 inhabitants, exclusively Chinese. The area of old Kau-Lung is three square miles. The total area of this colony is 391 square miles.

Climate.— The maximum temperature is 93° F. Rainfall is very heavy at certain seasons and the humidity percentage is so great during certain months that the climate is very trying to all except the native Chinese. December is the dry month of the year and is perhaps the most enjoyable month also. The European quarters have modern sanitation systems which ensure the community somewhat against the epidemics so frequent in this quarter of the world.

Education.— The government educational institutions comprise Queen's College, average attendance 490 boys, mostly Chinese; the Kau-lung, Peak and Victoria schools, for children of both sexes of British parentage, average attendance 60, 29 and 47, respectively; the Belilios Girls' School, average attendance 384; eight English schools for Chinese boys, average attendance 1,397; one English school for Indian boys, average attendance 51. There are 39 schools, mainly denominational, which are in receipt of government aid and are subject to government inspection, with an average attendance of 3,500. The net cost of education amounts to about $235,000 (Hongkong currency) annually. There is a police school and about 360 unaided schools with over 13,000 pupils. In 1906 a technical institute was founded. It is maintained by the local government and has over 500 students. Hongkong University was opened in March 1912, with faculties of arts, medicine and engineering. It has about 200 students at present.

Industry and Commerce.— The principal industries of the colony are cotton-spinning, sugar-refining, ship-building and repairing, rope-making, the manufacture of cement, brewing and the manufacture of knitgoods. Deep-sea fishing is growing in importance. The commerce is chiefly with Great Britain (about 50 per cent of both imports and exports), India, Australia and the United States. Hongkong is a free port except as regards the importation of intoxicating liquor and tobacco and there are no official returns of trade, only mercantile estimates, according to which the imports average $20,000,000 and the exports $10,000,000. It is the great distributing port for South China and trades in nearly all kinds of goods. Among the principal are opium, amber, sugar and flour, salt, earthenware, oil, amber, cotton and cotton goods, rice, sandalwood, coal, timber, hemp, kerosene, ivory, betel, live stock, granite, vegetables, etc. The tea and silk trade of China is largely controlled by Hongkong interests. In 1917 the colony exported goods to Great Britain valued at $7,284,035, and imported thence goods to the value of $15,355,245. Exports to the United States averaged about $3,000,000, and imports from that country, $10,000,000. The latter comprise mostly flour, oil and cotton.

In 1916, 24,201 vessels aggregating 11,062,288 tons entered the harbor, and 24,151 vessels of 11,246,173 tons cleared. About 20,000 fishing and other craft frequent the harbor and bays of the colony. The harbor is one of the best in the world, having extensive docking facilities and modern machinery. The only danger is from typhoons, which at times have caused great destruction.

Communications.—An electric railroad of nine and one-quarter miles and a cable tramway connect the Peak district with the lower levels of Victoria. There is a railway line to the Chinese frontier connecting with the Canton Railway. It was opened in 1910. The branch line from Fanling to Sha Tau Kok was opened in 1912. There are 17 post offices in the colony, the revenue from which in 1916 amounted to $216,165, and the expenditure for which amounted to $167,795. Telegraph lines, including cables, have a length of 254 miles. Telephone wires, excluding military lines, have a length of 8 272 miles. There are military and naval wireless stations and a postal wireless station. Hongkong, as one of the great marts of the world, has steamship connection with all great ports of Europe and America.

Finance, Money, etc.— In 1916 the revenue of the colony was $7,276,940, derived chiefly from land, taxes, licenses, quarry rent, liquor duties and an opium monopoly. The expenditures in the same year amounted to $5,828,500, a great part of which is devoted to the maintenance of a strong police force. The public debt amounts to about $7,200,000. The British banking institutions in the colony are the Hongkong and Shanghai Banking Corporation, the Chartered Bank of India, Australia and China, and the Mercantile Bank of India, Ltd. There are also several Chinese and foreign banks.

The currency consists of the notes of the above named banks, and of British, Hongkong and Mexican dollars, besides subsidiary coins. The British dollar is of 416 grains of silver, 900 fine; the Mexican, 417.74, of 902.7 fineness. The circulation of foreign copper coin was prohibited in 1912, and similar action is being taken in regard to foreign silver and nickel coins and bank notes. The Hongkong dollar is of variable value. In 1917 it was worth $0.525 in American currency.

History, Government, etc.— The Crown colony was ceded to Great Britain by China in 1841, the cession was confirmed by the Treaty of Nanking in 1842 and the charter is dated 5 April 1843. It is a military and naval station of first importance. The administration is in the hands of a governor, aided by an executive council, composed of the general officer commanding the troops, the colonial secretary, the attorney-general, the treasurer, the secretary for Chinese affairs, and the director of public works and two unofficial members. There is also a legislative council, presided over by the governor and composed of the commander, the colonial secretary, the attorney-general, treasurer, director of public works, superintendent of police, secretary for Chinese affairs and six unofficial members — four nominated by the Crown (two of whom are Chinese), one by the Chamber of Commerce and one by the justices of the peace. The courts of justice comprise a Supreme Court, a court of summary jurisdiction and a third court or appeal court, a police magistrates' court and a marine magistrates' court. In 1916, 1,418 were committed to jail; the daily average of prisoners in jail in 1916 was 638. The police force numbers 1,215 men, of whom 165 are European, 463 Indians and 587 Chinese.

Population.— The population of Hongkong, exclusive of the military and naval establishments, and the new leased territory, was, in 1911, 354,187 Chinese; 8,074 Europeans and Americans, and 3,884 other nationalities, a total of 366,145. The new territories contained 90,594, making a grand total for the colony of 456,739. The total estimated population in 1916 (including the new territories) was 529,000.

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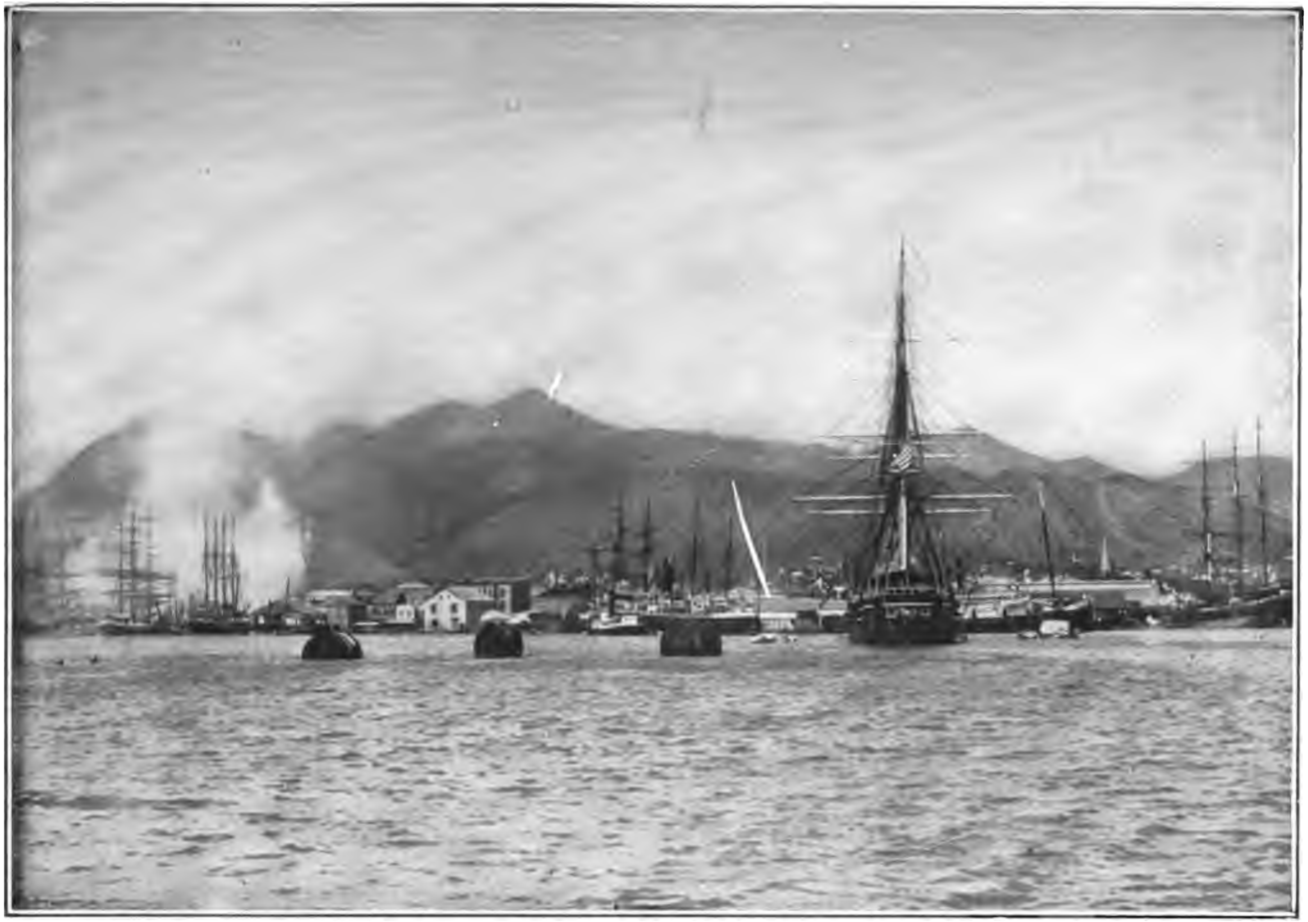
HONOLULU, Hawaii, capital and principal city of the Hawaiian Islands (now a United States Territory), and commercial metropolis of Polynesia; the business heart of the central Pacific. It is 2,089 miles southwest of San Francisco, in lat. 21° 17′ 56″ N., long. 157° 51′ 48″ W. It lies on the southwest side of Oahu (the third island of the group in size and northwest of Hawaii, with a safe harbor formed by a natural breakwater of coral reef, pierced by a broad opening. A fine lighthouse here throws a light visible for 25 miles. With its natural advantages and the absence of rivals, the city occupies a unique position. From its central location it is a common point of touch for the three great trans-Pacific steamship routes — from the United States and British Columbia to New Zealand and Australia, from the same to Japan, China and the Philippines and from South America to Japan and China. Several independent steamship routes also run from it. It has regular communication with San Francisco, Vancouver and Seattle, Peru, Auckland and Sydney, New York and Boston, Yokohama and Hongkong, Liverpool, Glasgow and Bremen, besides other places. The steamship line to Sydney touches at the Fijis; the line to Auckland, at Apia, Samoa. From Honolulu it is 3,850 miles to Auckland, about 4,000 to Sydney and 3,445 to Yokohama. It is the port of foreign trade for the archipelago; about 1,000 vessels and many millions worth of products pass in and out of it annually. There are numerous wharves and warehouses here and a government custom-house. (For the items of the trade, see HAWAII; the great items are sugar and molasses, rice, coffee, hides and wool).

Honolulu lies at the mouth of the valley of Nuuanu, which runs back between two high ridges to a pass between two peaks about 3,000 feet high in the great eastern range of mountains; the view from the brink of the *pali* or precipice at this pass is one of the notable sights of the neighborhood. The climate is mild and equable and many sufferers from lung troubles in the United States seek it for a sanatorium. The extreme range of temperatures is 52° to 88°, average 70°. The rainfall is very irregular, but never slight; from 40 to 60 inches annually. The island is volcanic, the bordering reefs coral; hence the city streets are macadamized with coral and lava, porous rock making good surface drainage. The city is well laid out in American fashion, being indeed a modern American place; the old one-story wooden huts, mingled with grass huts among the trees, have mostly given place to cottages, unpretentious indeed, but neat and comfortable, and making parts of a beautiful and picturesque whole of luxuriant gardens and surroundings of tropical trees, with which also some of the streets are abundantly shaded — the great Norfolk pine, papaya, bread-fruit, mango, and monkey-pod, umbrella-tree, tamarind tree, algaroba, bamboo and koa, date and cocoa palms, candle-nut, royal-palm and poinciana regia, alligator-pear, china-rose bush, blooming all the year round, etc., many with rich and fantastic blossoms, others with great parasitic ferns, besides peach, oleander, banana, guava, orange, citron and others.



Courtesy of the Philadelphia Commercial Museums

THE HARBOR OF HONOLULU

The flowers are also of great beauty and luxuriance.

The city has nearly 200 acres of public parks. There are all modern appliances and services for civilized work and comfort; several first-class hotels, physicians, lawyers, daily and weekly newspapers, banks and theatres, insurance offices, several hospitals, a public library, etc. There are 32 public schools, including a high school and normal school, with a total attendance of over 5,000 pupils, besides 37 private schools, with an attendance of 2,700 pupils. There are a number of churches, Protestant and Catholic; the city is the seat of a Roman Catholic and an Anglican bishop. It is also the residence of the government officials, and the consular agents of many European powers. It has waterworks owned and operated by the Territorial government and furnishing excellent water, pumped from artesian wells, supplemented by water from the adjoining valleys. Ice is made by machinery. There is an electric street lighting system operated by the government, and an electric street railway system, built and conducted by a chartered company; a telephone system; and there is a submarine cable to San Francisco and wireless telegraph to the neighboring islands and to the United States. Of manufactures the number of different lines is upward of 30, of course chiefly for local needs; the largest branch is foundry and machine-shop manufacture. Next to this is rice-milling. Minor industries are ice, harness, leather, jewelry, soap and shipbuilding.

The chief building is the former royal palace, now the executive building, in the Italian style, finished in 1882. The judiciary and other government buildings are near it. The most interesting place is the museum, with many curious relics of early Hawaiian history, corals and shells and other native curiosities, land and marine. The chief in interest and value is the great feather war-cloak of Kamehameha I, the founder of the monarchy, valued at $150,000. This was the chief treasure of the former sovereignty and was used as a mantle of state by the sovereigns. It was made of yellow feathers from the *mamo* bird, found only in the mountains, each bird furnishing only two small tufts of feathers for it, one from under each wing. It is four feet long and has a spread at the bottom of 11½ feet. Nine generations were employed in making it.

Honolulu harbor was discovered by Captain Brown in November 1794. The city as a modern foundation dates only from 1816, when John Young, an Englishman, and a faithful counsellor of the king, Kamehameha, advised its fortification. Previously it had been only a native village of huts, of little commercial importance. In 1820 it was made the capital of the archipelago, and afterward became the seat of government. Population about 63,000. Of the population of 52,183 in 1910, 15,618 were Hawaiians, 9,674 Chinese, 12,093 Japanese, 6,147 Portuguese, 4,233 Caucasian-Hawaiians and 9,200 other Caucasians.

HONORIUS I, hō-nŏ'rĭ-ŭs, Pope: d. 12 Oct. 638. He was elected Pope in 625. In the hope of allaying a controversy he temporized with the leaders of the Monothelite heresy, which, while recognizing the twofold nature of Christ, declared he had but one will, a doctrine condemned by the sixth Council of Constantinople. He was anathematized by the council that condemned the heresy. Pope Leo II, in confirming the acts of this council, says that Honorius was condemned for «not extinguishing the flames of incipient heresy.» For a full account of the case of Honorius, consult Parson, 'Studies in Church History' (Vol. I).

HONORIUS II, Pope: d. 14 Feb. 1130. He was elected Pope in 1124 and was at the time of his election bishop of Velletri. A section of the bishops and cardinals had previously invested Cardinal Thibaut with the papal dignity; but both candidates having resigned Honorius was re-elected.

HONORIUS III, Pope: d. 18 March 1227. He became Pope in 1216 on the death of Innocent III. He at once wrote to the king of Jerusalem to assure him of his support; to the bishops of France, to encourage pilgrims, and to the emperor of Constantinople to promise him assistance. John, king of England, had left to his successor, Henry III, the burden of a war with the French Prince Louis, who laid claim to the English throne and had been encouraged in his pretensions by Innocent. Honorius reconciled the barons with Henry, and obliged Louis to renounce his pretensions. He then turned his attention to the Crusades, and crowned Frederick II emperor of Germany, on condition that he would go to Palestine within two years. In France he instigated Philip Augustus and Louis VIII to support the war against the Albigenses. He was succeeded by Gregory IX.

HONORIUS IV, Pope: d. 3 April 1287. He was elected Pope in 1285 and supported the French king, Philip the Bold, in the war against Peter of Aragon.

HONORIUS, Flavius, Roman emperor, son of Theodosius the Great: b. Constantinople, 9 Sept. 384 A.D.; d. Ravenna, Italy, 26 Aug. 423 A.D. On the death of his father in 395 the empire was divided into two parts, Honorius receiving the western half, with Rome as his capital. The principal events of his reign are the adoption of rigorous measures against paganism in 399; the devastation of northern Italy by Alaric in 400–403; another irruption of barbarians under Rhadagasius 405–06. Both invasions were repelled by his able minister, Stilicho, who, however, fell under the displeasure of his weak and indolent master and was assassinated at Ravenna in 408. Taking advantage of the death of the defender of Rome, Alaric marched upon the city and plundered it in 410.

HOOCH, or **HOOGH, Pieter de**, pē'tėr dė hooн, or hōg, Dutch painter: b. Utrecht, 1630; d. Amsterdam, soon after 1677. His early art training was much influenced by Rembrandt. In 1655 he was enrolled in the Painters' Guild of Delft, where he resided, but later removed to Amsterdam. He was the chief representative of Dutch genre painting and his specialty was the delineation of Dutch interiors, with their semi-darkness, suffused by the witchery of sunlight. Sometimes he set out two or more rooms in perspective, the vista of which was drawn and lit up with extraordinary skill.

HOOD, Arthur William Acland Hood, BARON, English naval officer: b. Bath, 14 July 1824; d. Glastonbury, 16 Nov. 1901. After service on the coasts of Spain and of Syria, he was made lieutenant in 1846 and in 1854 commander in recognition of his services with the naval brigade before Sebastopol. Assigned to the China station, he participated in the capture of Canton (December 1857), and in 1858 received the commission of post-captain. In 1862–66 he was in command of the *Pylades* of the North American station, in 1866–69 of the *Excellent* and the Royal Naval College at Portsmouth, and in 1869–74 director of naval ordnance. He was promoted rear-admiral in 1876, was commander-in-chief of the Channel fleet 1879–82, was First Sea Lord of the Admiralty in 1885–89, and became admiral in 1886. In 1892 he was raised to the peerage. His attitude in connection with the development of the British navy was strongly conservative.

HOOD, Edwin Paxton, English Congregationalist: b. London, 18 Dec. 1820; d. Paris, 12 June 1885. He prepared himself for the ministry privately and held several pastorates, the last being at Falcon Square Church, Aldersgate street, London. He was exceedingly active in philanthropic work and succeeded in raising huge sums for the benefit of the Royal Hospital for Incurables. Among his best-known publications are 'Lamps, Pitchers and Trumpets: Lectures on the Vocation of the Preacher' (1867); 'The World of Moral and Religious Anecdote' (1870); 'The Throne of Eloquence: Great Preachers, Ancient and Modern' (1885); and biographies of 'John Milton' (1852); 'Andrew Marvell' (1853); 'Swedenborg' (1854); 'William Wadsworth' (1856); 'Isaac Watts' (1875); 'Thomas Carlyle' (1875); 'Oliver Cromwell' (1882); and numerous others.

HOOD, John Bell, American soldier: b. Owingsville, Ky., 29 June 1831; d. New Orleans, La., 30 Aug. 1879. He was graduated at West Point in 1853 and bore a commission in the United States army till 1861 when he joined the army of secession. The part he took in the Virginia campaign gained for him the rank of major-general and at Gettysburg his division made a gallant record in its position at the extreme right of the Confederate line. He took part in the battle of Chickamauga on 19–20 Sept. 1863, having come to Tennessee to the support of General Bragg. When General Johnston was endeavoring in the spring of 1864 to impede Sherman's advance on Atlanta, Hood was a lieutenant-general in his army and his corps, on 25 May 1864, was attacked by Hooker at New Hope Church. He succeeded Johnston the following July in the command of the Army of Tennessee, fought the battle of Peach Creek with Sherman 20 July 1864, but was compelled to retire behind the fortifications of Atlanta. After the battle of Jonesboro he retired from Atlanta, which was entered by Sherman. His attack on the forces under Schofield at Franklin being repulsed, he proceeded to Nashville, where he met General Thomas. Thomas advanced from his entrenchments on 15 December, and a two-days' battle ensued. Federal preparation had been carefully and deliberately made. A general attack on the afternoon of 16 December caused the entire Confederate line to give way. Soon Hood's army was in full retreat toward Franklin, the larger part of it "in great confusion," according to Hood's official report. After a nine-days' pursuit by the Federals, the remnant of the Confederates, now largely disintegrated crossed the Tennessee, Hood, at his request, was relieved of his command. Subsequent to the war he was a commission merchant at New Orleans. He wrote 'Advance and Retreat: Personal Experiences in the United States and Confederate States Armies' (1880), and articles for 'Battles and Leaders of the Civil War' (1887). Consult these works; see also NASHVILLE, CAMPAIGN AND BATTLE OF.

HOOD, Robin, English outlaw: said to have been b. 1160 and d. 1247. According to the popular account, with his followers, he inhabited Sherwood Forest, in Nottinghamshire, and also the woodlands of Barnsdale in the adjoining West Riding. They supported themselves by levying toll on the wealthy, and more especially on ecclesiastics, and by hunting the deer. The principal members of his band were his lieutenant, Little John, his chaplain, Friar Tuck, William Scadlock, George-a-Greene, Much the miller's son, and Maid Marian. His skill with the long-bow and quarter-staff was celebrated in tradition. What basis of fact there is for the story of Robin Hood is doubtful. Grimm maintained that he was one with the Teutonic god Woden. Other theories suppose him to have been a rebel yeoman in Lancaster's rebellion under Edward II; a Saxon chief who defied the Normans; and a fugitive follower of Sir Simon de Montfort after the battle of Evesham. He figures prominently in Scott's novel 'Ivanhoe,' and in 'The Foresters,' a drama by Tennyson. The earliest known mention of him is in 'The Vision of Piers Plowman,' version B. (about 1377), in which Sloth says he knows "rymes of Robin Hood." 'The Gest of Robin Hood' (assigned to 1400), almost epic in length, consisting of 456 four-line stanzas, is the oldest extant ballad on this theme. Others of the more important ballads are 'Robin Hood and the Monk,' 'Robin Hood and Guy of Gisborne' and 'Robin Hood's Death.' The remaining ballads are, in general, of inferior merit. It seems probable that there were what may be called a Sherwood cycle and a Barnsdale cycle, respectively. Many proverbs and sayings exist in connection with Robin Hood. Consult Child, 'English and Scottish Ballads' (1883); Fricke, 'Die Robin Hood Balladen' (1883) and Ritson, 'Robin Hood' (new ed., 1885).

HOOD, Samuel, VISCOUNT, British naval officer: b. Thorncombe, Devonshire, 12 Dec. 1724; d. Bath, Somersetshire, 27 Jan. 1816. He entered the navy in 1740, was promoted lieutenant in 1746, commander in 1754, and post-captain in 1756. While commanding the *Vestal* in 1759 he took the French *Bellona* after a three-hours' fight. From 1767 to 1771 he was commander-in-chief in North America. Having served as commissioner of the Portsmouth dockyard in 1778–80, he was made admiral of the blue in 1780, and almost immediately was sent in command of a squadron to reinforce Rodney on the North American and West Indian stations. He remained on that duty until the signing of the peace, and distinguished himself in several battles. Dispatched in 1781 to blockade Martinique, he was intercepted by De Grasse and the French fleet, against which he fought in April and in July (under Admiral

Graves). Again in the West Indies in 1782, after an absence along the North American coast, he outmanœuvered De Grasse in several minor contests, and later, on 12 April, took an important part in the victory of Dominica, when he led the rear of the British line. In 1784 he was elected to Parliament for Westminster, and in 1788 made a lord of the admiralty. He took command of the British fleet in the Mediterranean in 1793, and occupied Toulon. Hood had a great reputation as a tactician, and a high tribute was paid him by Nelson, who had been one of his subordinate officers. Consult James, 'The Naval History of Great Britain' (1822–24; new ed., 1837).

HOOD, Thomas, English poet and humorist: b. London, 23 May 1799; d. there, 3 May 1845. In 1821 he became sub-editor of the *London Magazine,* and from that time appears to have resolved on devoting himself entirely to a literary life. In 1826 he published 'Whims and Oddities.' This was followed by 'National Tales' in prose, and a volume of serious poetry, which, though favorably received, did not obtain much popularity. In 1830 he started the *Comic Annual,* which, during the eight years of its existence, was made the vehicle of many of his most remarkable productions. At the same time his pen was diligently employed on other subjects, and he published the powerful poem called 'Eugene Aram's Dream,' 'Tylney Hall,' a novel, which, though defective in its plan and structure, abounds in fine strokes of wit and humor. His health had begun to fail, and in consequence he lived on the Continent 1835–40. He continued his *Comic Annual* during his residence at Coblenz and Ostend, and in 1838 published *Hood's Own.* His continental experiences also furnished materials for his 'Up the Rhine' (1839), a series of imaginary letters after the manner of Smollett's 'Humphrey Clinker.' The whimsical cuts inserted in the work, as well as its combination of good sense and humor, made it very popular. Shortly after his return, he undertook the editorship of the *New Monthly Magazine,* and continued it until 1843. His principal contribution to it was the famous tragi-comic story in verse of 'Miss Kilmansegg.' His last periodical, entitled *Hood's Magazine,* was commenced in 1844. It contains some of his best productions, though several of them were written after his health had completely given way, and while he was propped up by pillows in bed. Hood is unrivaled as a punster, and seems to have been almost equal master of the comic and the pathetic. In the latter style his 'Song of the Shirt' is universally known, and as a burst of poetry and indignation gave him enduring fame.

HOOD, Thomas, generally known as TOM HOOD, English miscellaneous writer; son of the preceding: b. at Wanstead, Essex, 19 Jan. 1835; d. Peckham Rye, Surrey, 20 Nov. 1874. He was educated at Oxford with a view to a clerical career, but did not graduate; he edited the *Liskeard Gazette* in 1858–59, and from 1860 till 1865 was a clerk in the accountant-general's department at the War Office. In 1865 he became editor of the comic paper called *Fun.* His first separate publication was 'Pen and Pencil Pictures' (1857), and among his subsequent works are 'The Daughters of King Daher, and other Poems' (1861); 'Jingles and Jokes for the Little Folks' (1865); 'Captain Masters's Children' (1865), his best novel; 'A Golden Heart' (1867); 'The Rules of Rhyme: A Practical Guide to English Versification' (1869), a work which has gone through two later editions; 'From Nowhere to the North Pole' (1874). From 1867 he produced *Tom Hood's Comic Annual.* A volume of his 'Favourite Poems,' with a memoir by his sister, Mrs. Broderip, was published in the United States in 1877.

HOOD, Mount, a peak of the Cascade Range, in the northern part of Wasco County, in Oregon. The height is usually given as over 11,225 feet, but the latest explorers claim it is nearly 12,000 feet. Mount Hood was at one time an active volcano; the lava is found on the slopes and some distance from its base.

HOOD RIVER, Ore., name applied to a valley, town and river in Wasco County. The town is situated on the Columbia River and on the line of the Oregon-Washington Railway and Navigation Company, 66 miles east of Portland and 22 miles below The Dalles, the county-seat. The Hood River strawberry has acquired a reputation almost phenomenal, and is distributed over an immense area of country extending from Denver and Omaha on the south to Winnipeg in the province of Manitoba to the north and east. The apple industry is also rapidly assuming large proportions, grades of superior excellence are produced, and the highest priced Spitzenburgs and Yellow Newton Pippins found in the markets of New York and London were grown in Hood River. The valley proper extends south from the Columbia River to Mount Hood, some 20 miles, and is protected and cradled by the Cascade range of mountains on the west and a high divide putting out from Mount Hood on the east. The amount of land adapted for fruit culture in this unique valley exceeds 50,000 acres. The river itself drains all of the north side of Mount Hood, has a large and constant flow of water, and for the last 10 miles of its course before entering the Columbia has an average fall of over 60 feet per mile, affording 10,000 measured horse power per mile. There are immense forests of fir and cedar about the head-waters of this stream, and one of the largest saw-mills in the State is conveniently situated near its confluence with the Columbia. The climate is a happy mean between the moist section of western Oregon and the semi-arid plains of the Columbia. The scenery is grand in the extreme and yearly attracts the attention of many visitors. The town is pleasantly situated, overlooking the Columbia River, is supplied with electric lights, has a Carnegie library, county hospital, high school, and operates its waterworks, while the telephone is universally present in both town and country. It is, however, the superlative excellence of its fruits that has given Hood River a reputation almost world-wide. The town has saw and planing mills, canneries, evaporators, a vinegar factory, meat-packing plant, cider and syrup factories, machine shops, wagon works and a co-operative creamery. Pop. of town 2,331, valley about 6,000.

HOODED CROW, a crow native in northern Europe (*Corvus cornix*), so termed in allusion to markings on the head. Head, wings and fore parts are jet black, the rest of the bird ash-gray; bill and feet are black. It retires to the southward from its more northerly haunts at the time of the crow migration. In England it is known as the gray, dun or Royston crow. The hooded crow found in India is similar in general appearance, but is a smaller species.

HOODED SEAL, a large dark-gray spotted seal of the north Atlantic, closely related to the common harbor seal, and named *Cystophora cristata.* It reaches a length of about 10 feet, and is especially distinguished by a large inflatable sac upon the face, the expansion of which is thought to be a defensive device, calculated to terrify enemies. It is occasionally seen on ice-floes along the Labrador coast.

HOODED WARBLER, a fly-catching warbler (*Sylvania mitrata*), common in the southern United States in summer and making its nest in low bushes. It is bright yellow except a solidly black crown, neck and breast, comparable to a hood, leaving the face golden yellow.

HOODOO. See MASCOT.

HOOF, a toe-nail which is large, envelops the terminal phalange, and is of material assistance in walking, as in the case of horses, cattle and other ruminants, and in the elephant, rhinoceros, etc. It is most highly developed in the horse, where the whole terminal part of the foot is reduced to a single, well-booted toe. In split-hoofed or cloven-hoofed animals there are two toes approximately equal, and booted with hoofs flat on their inner sides and closely appressed. The small non-functional toes hanging behind the hock-joint in most split-hoofed animals are often called «false hoofs.» Accidents and diseases affect the hoofs of domestic animals (see FOOT-ROT, etc.), and require careful attention, especially in the case of horses. The soundness of a horse's foot is mainly preserved by permitting it to grow uninjured by the rasp and knife, and kept clean by being washed with cold water; all other applications are injurious and destroy the toughness of the «horn surface.» Softness and brittleness of the hoof, which are fruitful sources of cracks and corns, may be remedied by placing the feet for several hours daily in thick woolen swabs, kept cool and moist by frequent applications of cold water, and by encouraging a more healthy growth of horn by occasional mild blisters round the coronary band. Cracks (or sand-cracks) mostly occur among horses much upon the road, cause lameness and constitute unsoundness. When serious and recent, poulticing, thinning away of the crust about the crack and perfect rest are essential. After the earlier heat and tenderness are removed a hot iron should be drawn at right angles to the crack, both above and below, so as to separate the diseased from the sound horn. Waxed thread or fine wire should be wound round the hoof, and a sound growth of horn stimulated by a blister round the coronet.

HOOFT, Pieter Corneliszoon, pē-tĕr kor-nā'lēs-zōn hōft, Dutch poet and historian: b. Amsterdam, 26 March 1581; d. The Hague, 21 May 1647. He was son of that Cornelius Hooft who did much to procure Elizabeth's recall of the incompetent and tyrannical Leicester in 1587. He traveled through France, Italy and Germany in 1601, and on his return began with patriotic ardor to improve and purge the speech of his mother country. With this aim in view he translated Tacitus into Dutch, and made that Latin writer the model of his style, as a historian. His historical writings are vivid and comprehensive. His poems are chiefly in the erotic vein. He also produced dramas in the form of pastoral, tragedy and comedy. In his comedies the domestic life of the Netherlands is admirably portrayed. In the castle of Moritz, Prince of Orange, at Muiden, where he lived as high bailiff, he used to gather round him a coterie of brilliant men and women, and this intellectual circle famous as the «Muiderkring» included the poets Huygens, Vondel and Baerle. His principal works are ‹Hendrik (IV) de Grote zijn leven en bedrijf› (1626); ‹Nederlandsche Historien› (1642); the poems ‹Minneliederen›; ‹Afbeeldinglien van Minne›; the pastoral drama ‹Granida› (1605); the tragedies ‹Geeraerdt van Velzen› (1613); and ‹Baeto› (1616); and the comedy ‹Warenar.›

HOOK, Theodore Edward, English novelist and journalist: b. London, 22 Sept. 1788; d. 24 Aug. 1841. As a mere lad, sometimes in conjunction with his father, and sometimes on his own account, he wrote 13 farces and melodramas. For a time Hook led a life of gaiety in London, and became notorious for practical jokes and similar escapades. In 1812 he through the favor of the Prince Regent, although he was quite unversed in business and even in arithmetic, was appointed accountant-general and treasurer of the island of Mauritius; but, owing to his gross incompetence, a large deficiency in the military chest was discovered, and in 1818 he was sent home under arrest, and although no proceedings were taken against him, the liabilities thus incurred were a millstone round his neck ever after. In 1820 he was appointed editor of *John Bull,* a journal established in order to lampoon Queen Caroline and her supporters, and this paper he conducted till 1841. From this source he obtained at first an income of £2,000 a year. The years 1823–25 were spent in the debtors' prison. At intervals from 1824 to 1828 he published his ‹Sayings and Doings› while in 1836 he became editor of the *New Monthly Magazine.* His other principal works are a series of novels, among which may be mentioned ‹Love and Pride›; ‹Jack Brag›; ‹Gurney Married›; He figures in fiction as the Lucien Gay of Disraeli's «Coningsby,» and as the Mr. Wagg of «Vanity Fair.» Consult Barham's ‹Life and Remains of Hook› (1849).

HOOKER, hŭk'ĕr, **Edward,** American sailor: b. Farmington, Conn., 1822; d. Brooklyn, N. Y., 1 May 1903. He followed the sea in the merchant service until the outbreak of the Civil War when he joined the United States navy as acting master and served with distinguished bravery. He was commissioned as lieutenant-commander in the regular naval service in 1884 and full commander two years later, when he retired.

HOOKER, Isabella Beecher, American philanthropist: b. Litchfield, Conn., 22 Feb. 1822; d. 25 Jan. 1907. She was a daughter of Dr. Lyman Beecher (q.v.) and in 1841 married Joseph Hooker, a lawyer. She made a special study of the right of women of the United States to vote; was active in various reform movements, and was widely known as a public speaker. She wrote 'Womanhood, Its Sanctities and Fidelities.'

HOOKER, Joseph, American soldier: b. Hadley, Mass., 13 Nov. 1814; d. Garden City, N. Y., 31 Oct. 1879. He was graduated at West Point in 1837 and received a commission in the First Artillery. He served in Florida and on the northeast frontier 1837–40 and during the Mexican War was aide to Generals Smith, Harmer, Butler and Pillow. He saw much service in both the northern and southern campaigns and resigned from the army in 1853. From that date to the breaking out of the Civil War he was successively farmer, engineer and militia colonel. In 1861 he went to the front as a brigadier-general of volunteers. In 1862 he was commissioned major-general of volunteers and was present at the battle of Williamsburg, Va., and was subsequently conspicuous in the Peninsular campaign and in the battles of Bristoe Station and Chantilly. He also took part in the Maryland campaign, and in September of 1862 was appointed brigadier-general in the regular army. Two months later he was placed in command of the Fifth corps, and at the battle of Fredericksburg commanded the Third and Fifth corps. In 1863 he was put in command of the Army of the Potomac, but although very successful in refitting and reorganizing his troops, failed to show, as head of an army, those qualities which had characterized him in the field as corps and division commander. At Chancellorsville the defeat of the Federal troops by General Jackson was largely due to Hooker's vacillation and his want of power to cope with the sudden surprise of his right flank by the Confederate general. Public opinion in the North and an increasing lack of confidence in Hooker on the part of President Lincoln led to his resignation from his command and on 28 June 1863 he was succeeded by General Meade. He was then given commaned of the 11th and 12th corps, later combined in the 20th corps and on 24 Sept. 1863 was dispatched in command of the Army of the Cumberland to reinforce Rosecrans at Chattanooga and distinguished himself on 24 November in the so-called "Battle among the Clouds" on Lookout Mountain. He was brevetted major-general in the regular army in 1865, and a paralytic stroke forced him to retire from active service with that rank in 1868. An equestrian statue of Gen. Joseph Hooker by the sculptor French, was unveiled on Beacon Hill, Boston, 25 June 1903, with imposing ceremonies.

HOOKER, Sir Joseph Dalton, English surgeon and botanist: b. Halesworth, Suffolk, 30 June 1817; d. aged 94, Sunnydale, 10 Dec. 1911. His father was Sir William Jackson Hooker, regius professor of botany at Glasgow University, and his mother the daughter of a banker, Dawson Turner, of Great Yarmouth. Educated at the High School and University of Glasgow, he took his M.D. degree in 1839. He was only 21 when he accompanied the famous expedition of Sir James Clark Ross in the *Erebus* and *Terror*, sent out by the government to investigate the phenomena of terrestrial magnetism in the south circumpolar seas. His official or nominal position was that of assistant-surgeon, but in reality he was the naturalist of the expedition. His researches during this voyage resulted in a series of priceless volumes on the botany of the southern regions, embracing the Antarctic Islands, New Zealand, Tasmania and Fuegia. He succeeded in extending our knowledge of the laws governing the distribution of plants by comparing those he found with the flora of other parts of the world.

Returning home after four years he became botanist to the Geological Survey of Great Britain in 1846, and in 1847 went to India to study the flora of a hitherto unknown region of the Himalayas. Returning in 1851, he published two volumes of 'Himalayan Journals' and other botanical works on India. In 1855 Hooker was appointed assistant director of Kew Gardens under his father, succeeding on the death of the latter to the directorship in 1865, and resigned in 1885. In 1868 he was president of the British Association, and president of the Royal Society 1872–78. He visited Syria and Palestine for botanical study in 1860; the Atlas Mountains in 1871, and the Rockies in 1877. On his return he presented to the Royal Botanical Gardens (Kew) a large collection of seeds and museum specimens, and a herbarium of some thousand species, together with a mass of notes on the distribution of North American trees. He was the recipient of many honors and medals for his eminent services in scientific geography by promoting an accurate knowledge of the floras and economic vegetable products of the colonies and dependencies of the British Empire. In 1907 King Edward conferred the rare distinction of the Order of Merit upon him. Hooker was twice married (in 1851 and 1876), and left six sons and two daughters. A list of his writings forms almost a botanical catalogue, for he wrote thousands of monographs in addition to his larger works. The great 'Index Kewensis' (Oxford 1893–94) was compiled under Hooker's direction at the request and expense of Darwin (d. 1882).

HOOKER, Richard, English theologian: b. Heavitree, near Exeter, March 1554; d. Bishopsbourne, 2 Nov. 1600. He was educated at Oxford. In 1581 he took orders, and was shortly after made preacher at Saint Paul's Cross, in London. In 1584 he became rector of Drayton Beauchamp, Buckinghamshire. The following year he was appointed by Archbishop Whitgift Master of the Temple for life. Here he became engaged in a controversy with his colleague, Walter Travers, whose sympathies were strongly Puritanical, and to this controversy we owe his celebrated work 'Of the Laws of Ecclesiastical Polity.' The first four books were printed in 1594. The fifth book of his great work appeared in 1597; the last three in 1600. 'The Ecclesiastical Polity,' written in defense of the Church of England, is no less remarkable for learning and extent of research than for the richness and purity of its style, which entitles its author to be regarded as one of the classics of the Elizabethan Age. Consult Lives by Walton and Keble.

HOOKER, Thomas, American colonial clergyman: b. Markfield, Leicestershire, England, probably 7 July 1586; d. Hartford, Conn., 7 July 1647. After being graduated at Cambridge he took orders, preached in London and was chosen lecturer at Chelmsford in 1626. Having been silenced by Laud for non-conformity, he established a grammar school, and about 1630 went to Holland, where he preached at Delft and Rotterdam. In 1633 he came to New England with Cotton and Stone, and was settled with the latter at Newtown, now Cambridge, being ordained by the brethren of the church. In 1636 he removed with about 100 others to what is now Hartford, Conn., where he and Stone were the first ministers of the church. He was a remarkably animated and able preacher, of commanding presence and earnest zeal, and he has been called the Luther of New England. It was his custom to preach without notes. Some 200 of his sermons were sent to England, where about half of them were published. His most celebrated work, 'A Survey of the Summe of Church Discipline,' written with John Cotton, was published in England (1648). Many of his works have gone through repeated editions. Consult Walker, 'Life of Hooker' (1891).

HOOKER, Sir William Jackson, English botanist: b. Norwich, 1785; d. 12 Aug. 1865. He applied himself to the study of botany at an early age, and in search of botanical specimens visited Scotland and the Scottish islands, France, Switzerland and Iceland. His investigations on the British 'Jungermanniæ and Mosses' drew attention to his attainments, and he was elected to the chair of botany in the University of Glasgow, a position he filled for 20 years. In 1836 he was knighted, and in 1841 was appointed director of the Royal Gardens at Kew, a post which he held up to the time of his death. Under his management these gardens increased their area from 11 acres to 270. They are well laid out, and contain hothouses and conservatories far superior to anything of the kind on the Continent, and include museums filled with objects derived from the vegetable kingdom, botanical libraries and a most extensive and excellently arranged herbarium. Among his works may be mentioned 'Tour in Iceland' (1811); 'The British Flora'; 'Flora Boreali-Americana'; 'Illustrations of the Genera of Ferns, Icones Plantarum'; 'British Ferns,' etc.

HOOKER, Mount, Canada, a peak in the Rocky Mountains, 15,690 feet high, near the eastern boundary of British Columbia.

HOOKS. See Shore Lines.

HOOKWORM, Anatomy and Life History. The hookworms or ankylostomes are true roundworms (Nematoda, q.v.) and belong to the order of the strongyles. They are characterized by a well-developed buccal capsule armed with teeth or cutting plates, and in the male a fan-shaped bursa around the posterior end of the body. The anterior end is curved dorsad so that the mouth opens toward the wall of the intestine though the worm, when attached, lies parallel to the lining of the canal.

The hookworms are all dangerous bloodsucking parasites, and give rise to profound and lasting anemias in the host. Many species are known to occur in the higher mammals; two are found in man, often called the Old World and the New World hookworm. The former was discovered in 1843, though the disease to which it gives rise was recorded in ancient writings and the effects of its presence are recognizable in many regions and races. It is designated scientifically *Ancylostoma** *duodenale*.

The New World hookworm, *Necator americanus*, was discovered by Stiles in 1902 in the South and has proved to be the most common form in North, Central and South America. Later recognized by Looss among the parasites from pigmies in forests of Central Africa, it is now thought to have been imported into the western continent by the slave trade. The negro seems to be tolerant of its presence but in the white to which it has been abundantly transferred in the regions where the two races are in close contact, it evokes a most serious anemia which results in marked physical and

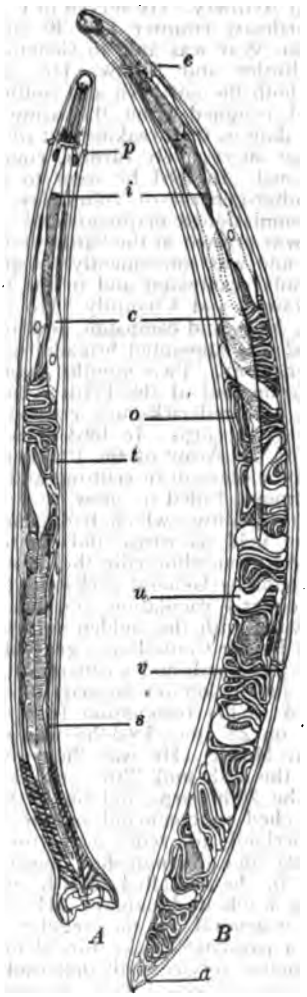


Fig. 1.—*Ancylostoma duodenale* — × 15 (After Looss). *A*, Adult male seen from ventral side. *B*, Adult female seen from right side. *a*, anus; *c*, cervical gland; *e*, excretory pore; *i*, intestine; *o*, ovary; *p*, papilla; *s*, spicule; *t*, testes; *u*, uterus; *v*, vagina.

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* The exact spelling of this name, which has been written in some 20 different ways, following an erroneous orthography employed by the discoverer of the worm, has finally been settled as given here by the International Commission on Zoological Nomenclature.

mental deterioration of the white host. Stiles regards the present condition of the “poor white trash” of the South to be due largely to its attacks. The two hookworms are so much alike in appearance that careful microscopical examination is demanded for their differentiation. Their effects on the host are in general similar though those due to Necator are more intense and persistent.

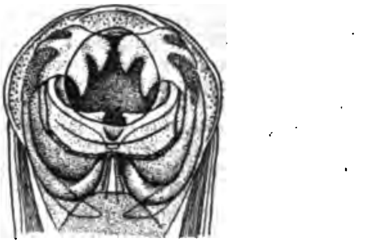

FIG. 2.— Oral capsule of *Ancylostoma duodenale* from man in Egypt. Viewed from in front (dorsal aspect). On each side two heavy teeth, the inner (upper) one of each set carrying a minute accessory denticle. × 100. (After Looss).

The adult *Ancylostoma duodenale* (Fig. 1) measures in the male 8 to 11 mm. in length by 0.4 to 0.5 in breadth, and in the female 10 to 18 mm. long by 0.5 to 0.6 wide. The most significant region is the anterior end (Fig. 2, A). On looking down into the oral capsule one notes at the anterior ventral margin two pairs of large uncinate teeth turning inwards, and deeper within the capsule two short lateral cutting plates. In Necator the corresponding region (Fig. 3) shows that the ventral teeth are replaced by broad cutting plates and the deeper lateral plates are lancet shaped. These differences facilitate a diagnosis when the microscope is employed.

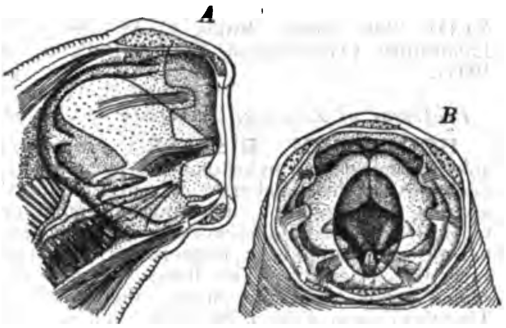

FIG. 3.— Oral capsule of *Necator americanus* from man, Central Africa; *A*, lateral aspect; *B*, dorsal view. The armature consists of cutting plates which completely close the upper part of the oval mouth opening and of lancet-like teeth on the bottom of the capsule. (Compare with Fig. 2). × 240. (After Looss).

The bursa of the male *Ancylostoma duodenale* (Fig. 4, A), is also easily distinguished under suitable circumstances from that of the male *Necator americanus* (Fig. 4, B), as appears from the figures.

The life history of the hookworm is strikingly complex. The eggs are thin shelled and when evacuated in feces are ordinarily in the four-celled stage, i.e., they have started on development but little and hence are readily distinguishable from those of other nematodes with which they are associated and might be confused (Fig. 6). Development proceeds within the eggshell slowly, the rate varying with the external temperature, until the embryo takes form (Fig. 7) and later a minute larva (Fig. 5, *a*) is hatched out. This passes its existence free in mud or feces until, after the second molt, the second stage of development lies within the larval skin of the first and in a cyst so that this worm is often spoken of as the encysted stage (Fig. 5, *b*). In this form known as the infective stage it seeks out water and there awaits an opportunity for gaining entrance into a new host. Eggs or younger larvæ do not cause infection even when introduced into man by chance.

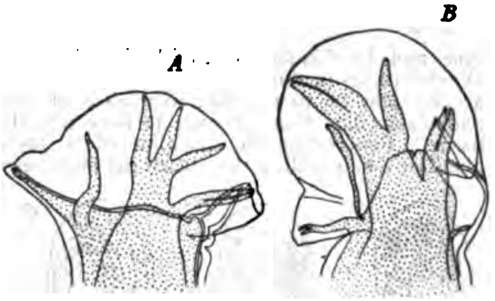

FIG. 4.— *A*, Bursa of *Ancylostoma duodenale*, seen from the left side. Bursal lobes short, distinctly broader than long, ribs moderately thick. × 60. (After Looss). *B*, Bursa of *Necator americanus*, seen from the left side. Bursal lobes longer than broad, ribs in general heavier than in *A. duodenale*. × 60. (After Looss).

The distribution of human wastes over the surface of the ground as is prevalent in many regions gives the chance for the young larvæ on hatching out to be dispersed generally in the mud and water of the soil. In those regions where the temperature does not go low enough to kill these larvæ the top layer thus becomes loaded with them in the infective stage. By the contamination of food and water supplies they may gain access directly to the human alimentary system, and such direct infection does take place though doubted by many after the indirect method of infection had been discovered. It seems likely, however, that the in-

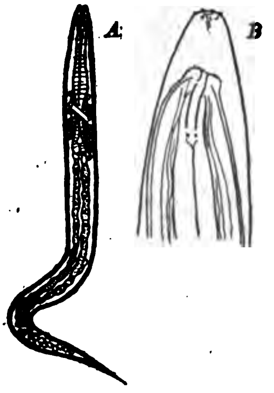

FIG. 5.— Larva of *Ancylostoma duodenale*; *A*, newly hatched in rhabditiform stage, × 230; *B*, anterior end of same during first ecdysis. × 640. (After Looss).

direct method is the more common as it is surely the more difficult to combat.

The facts in the indirect method were determined by Looss in Egypt for the Old World type and by Claude A. Smith for the New World species in this country. When the larvæ are brought on to the skin in masses of mud and water they essay at once to bore into the tissue. Penetrating the opening of a sweat gland or a hair follicle they reach the more open inner layers where they enter the lymph spaces and are ultimately carried into the blood stream. Borne by it into the lungs they desert the vessels to enter the air spaces. Here one finds them in the surface mucus, moving outward. They ultimately ascend the trachea to the pharynx and pass over into the esophagus down which they travel to the stomach and intestine, thus completing their migrations. In the course of their wanderings they undergo two molts during which the structures of the adult are gradually acquired. In the intestine sexual maturity is attained in a short time and the production of eggs completes the cycle.

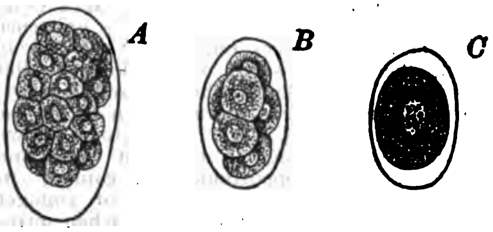

FIG. 6.— Eggs of *A, Trichostrongylus instabilis* which might be confused with the hookworm; *B, Necator americanus*; *C, Ancylostoma duodenale*. All three × 205. (After Looss).

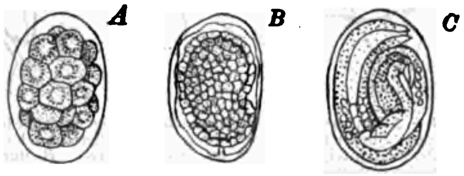

FIG. 7.— Developing eggs of *Ancylostoma duodenale* from old feces. × 205. (After Looss).

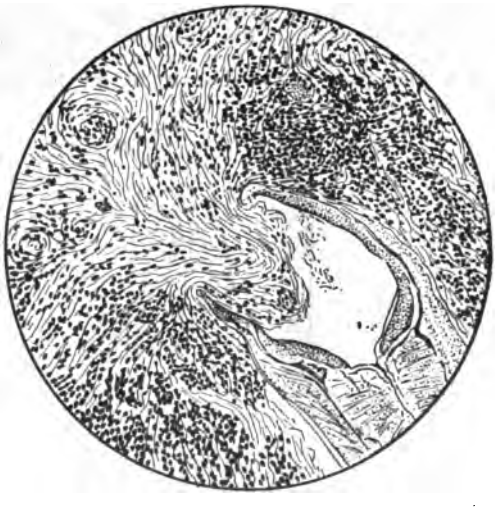

FIG. 8.— Section of head of *Ancylostoma* attached to intestinal wall, showing plug of tissue drawn into the oral capsule. The mucosa and villi have completely disappeared from this area. × 160. (After Looss).

The hookworm attacks the surface of the intestinal wall, rasping and sucking away the delicate inner cells on which in fact — not on blood — the animal feeds, and laying bare the deeper layers (Fig. 8). To the effects of this severe mechanical injury is added another influence of serious import: the worm produces in large salivary or cervical glands (Fig. 1, *c*) a secretion of marked hemolytic power which inhibits the coagulation of the blood. As a result the wound continues to bleed for a long time, even after the worm has deserted the spot to which it was attached.

It is evident that environmental conditions play a large part in determining the frequence of the parasite since they favor or hinder its development in the free stage and the coincident infection of man. Since the eggs are killed by a temperature of 34° F. in 24 to 48 hours the parasite never becomes abundant north or south of the subtropical zones. The encysted larvæ will live readily a month or even a year in moist soils but perish rapidly when the earth dries out; consequently moist climates and heavy water-filled soils favor the spread of the parasite whereas dry seasons or absorbent soils bring about its rapid elimination whenever it chances to be introduced. For further data consult Looss, A., 'Records of the Egyptian Government School of Medicine' (Vols. III, IV; 1905, 1911); Smith, Claude A. (in *Journal* of the American Medical Association, Vols. XLI, XLIII; 1903, 1904); Stiles, C. W., Hygienic Laboratory (Washington, D. C., Bulletin 10, 1903).

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HOOKWORM DISEASE, *synonyms:* ankylostomiasis, anchylostomiasis, uncinariasis, dochmiosis, brickmakers' anæmia, miners' anæmia, geophagia or dirteating, Egyptian or tropical chlorosis, tunnel-workers' anæmia, tunnel disease (and very improperly), malarial cachexia or anæmia. The disease has also received other names in many other tongues. That this disease existed in Africa and perhaps other countries from time immemorial there can be no reasonable doubt, but it was only within recent times that its cause was discovered. Clinically the malady seems to have been first accurately described by Piso, in 1648, he having observed about that period persons evidently afflicted with the disease in Brazil, though he was ignorant of its causation. Although the affection was unquestionably very common in most tropical countries, and must have been encountered by all practitioners in these regions, nothing further appears to have been written concerning it until just a hundred years later, when it was observed in Guadeloupe, and a short time thereafter in Jamaica. Following this, under the name of "miners' anæmia," it was described in Hungary, and later in Bohemia and France. Subsequently the worm which causes the malady was discovered by Dubini, of Milan, in 1838, who proposed that the parasite be called ancylostoma which he first misspelled "agchylostoma," from two Greek words meaning «bent mouth.» Notwithstanding that others had preceded him in finding quite similar and closely related worms in the intestines of various animals, and regardless of the fact that this investigator failed to recognize the vital connection that exists between the presence of these parasites in the alimentary tract of the human being and the profound anæmia that follows, his work was of elementary importance in paving the way for a proper comprehension of this insidious, common and fatal affection.

The connection between these worms and the symptoms that they produce when living in the intestinal tract of the human being was first clearly established by Bilharz, in 1853, and Griesinger, in 1854. In the succeeding years this parasite was discovered in many countries of southern and middle Europe,— being mostly found in laborers in tunnels, mines and brick-making establishments. Previous to this, as early as 1808, «dirt-eating» was described in America by Pitt, and, about a half century later, still more fully by Duncan. Although several cases of the disease of foreign origin had been previously reported, the first recorded cases of the endemic hookworm disease of the United States are those of A. J. Smith, who, in 1901, recognized the eggs of the parasite in a sailor who had lived for some time in America. It is of interest to note that the writer of this article observed and sketched the eggs of what was in all probability this parasite from a patient with amœbic dysentery about 1892, but, misled by the absence of all records of the disease in the new world, failed at the time to identify them. In the meantime the extreme prevalence of hookworm disease in the southern portions of the United States was slowly gaining recognition, and after some years was generally accepted as one of our most common and most serious diseases. Such importance did the subject later assume that the principal efforts of the boards of health of the Southern States have in recent years been directed toward combating this old but newly discovered affection. Some years ago a commission was formed for the eradication of the hookworm, and still more recently, owing to the fact that the malady was found extremely common in the West Indies, in Central and South America, and in other tropical countries, the activities of this commission have been greatly enlarged and its beneficent influences extended to these countries, preventing much suffering, saving many lives, and at the same time preparing the countries affected for the advance of civilization.

The principal pathological change produced by the hookworm consists in a profound anæmia, characterized by a great diminution in the hæmaglobin or coloring matter of the blood. In the young — who are unfortunately the most common sufferers — the alterations of the blood cause a retardation of development in every part of the body, and if the infection persists, as is often the case, the victim is permanently stunted,— being often left for life a dwarf both mentally and physically.

Where the worms attach themselves to the mucous membranes of the gut there is a local lesion, with more or less destruction of the epithelial coating, surrounded often by an area of swelling and redness. In some instances this process goes on until small ulcers are formed on the inner surface of the intestine. Of course under such circumstances there are found sometimes extensive inflammatory deposits in the mucosa, and even in the submucosa of the wall of the gut. Among the morbid changes produced by the parasite the dermatitis induced by its larvæ as they pass through the skin should not be forgotten. The symptoms produced by the presence of the hookworm in the alimentary canal of the human being may be in a general way inferred from what has been said of the pathological changes brought about by the parasite; naturally, the number of worms present in the intestinal tract — which may be from a very few to several thousand — and the age and size of the individual attacked modify more or less their severity. No greater mistake could be made, however, than to assume that such influences completely control the clinical picture, since individual susceptibility to the malign influences exerted by the parasite largely determines the severity of the resultant symptoms. On the other hand the degree of dermatitis produced is doubtless greatly influenced by the number of the larvæ that pass through the skin, but even here it is more than probable that some individuals react more pronouncedly than others. It is of importance to emphasize the fact that where the individual has a light infection, or where there is a high degree of resistance to the disease-producing power of the parasite, few and insignificant symptoms may occur, and the victim may be only slightly indisposed, or even appear to be in perfect health. This is particularly apt to be the case in the negro. Under such circumstances, however, the matter should not be treated lightly, since such persons act as carriers of the disease, and are a grave menace to their neighbors under certain circumstances. When hookworm larvæ in any considerable numbers attack the skin there is a feeling of irritation and burning, which is quickly followed by swelling, an increase in the uncomfortable symptoms and a severe itching. In from 24-36 hours there form in the affected area small blisters, which, when numerous, are apt to coalesce; in another day the vesicles become pustules, as a result of their watery constituents becoming infected with the germs of suppuration. The tops of the pustules become scabs, and gradually fall off, leaving the raw surface beneath, and in effect forming sores; slowly these heal, so that in from two to three weeks, as a rule, the parts return to a normal condition,— though leaving the surface attacked more or less discolored. The condition described is the so-called «ground itch.» In the meantime no general effects are observed in the patient, except that at first the lymph nodes, or «glands,» are enlarged and tender in the affected area, and there may be a slight rise in temperature, lasting only a short time. Following this the victim appears to return to a perfectly normal condition,— it being six weeks or two months before he begins to exhibit the symptoms that result from the presence of the worms in the intestine. If the number of worms be sufficient and the patient does not develop sufficient immunity there now begins a gradual decline in strength and general health of the infected individual, accompanied by a certain amount of pallor, which may in extreme cases become the most prominent objective symptom of the affection. Usually the patient complains of slight tenderness and pains in the upper part of the abdomen, not uncommonly associated with more or less indigestion, and often constipation as well. The victim is often sluggish, and frequently, though by no means always, shows a disposition to avoid exertion of any character, but this is simply the result of a want of physical strength, which by no means warrants the somewhat unflattering characterization of "laziness," which has been so commonly and indiscriminately bestowed on it. Where the disease is severe the patient may in time become so weak that all labor is impossible,— not infrequently accentuated by a shortness of breath that becomes manifest on the slightest exertion. In such cases the feet, legs, face and other parts of the body often become œdematous, and collections of fluids may occur in the abdomen, pleural cavity, the pericardium and other serous sacs. As is the case in other profound anæmias the patient looses little or no flesh. Where conditions such as those just described occur, death may result if the parasites are not expelled. On examination the blood shows interesting but no characteristic changes. In severe cases there is a great and even extraordinary diminution in the red coloring matter of the blood — being sometimes as much as 90 per cent — but strange to say there is no corresponding decrease in the number of the red cells, which are carriers of the coloring matter just mentioned,— in this respect resembling the alterations that occur in the peculiar anæmia of young girls called chlorosis; however, if the disease persists for a long time there is a very gradual falling off in the red cells, but even in such instances the number of these cellular elements rarely go below 50 per cent. In the average case of hookworm disease the number of red cells will be from 3,000,000–4,500,000 to the cu.mm. of blood. There are no marked changes in the white cells,— though there is generally a slight increase in their number; not usually there will be found on examination the normal 6,000 cells to the cu.mm., but much more commonly there are 8, 9, 10 or even as many as 18,000. Differential count usually shows nothing but an increase in the osinophile cells,— they being generally from 5–8 per cent of the total number. The most striking and wholly pathetic effects of the hookworm are observed in the young. Where the parasite attacks its victims in early youth, and infection constantly recurs during the succeeding years, it would be difficult to imagine that anything could produce more frightful results. In addition to the symptoms already described the wretched victim almost wholly ceases to develop, and usually remains throughout life dwarfed, and a pitiful travesty on humanity. Under such circumstances the sufferer when between 20 and 30 may appear a youth of not more than 8 or 10, without beard, or hair about the pubes, physically weak and incredibly stupid; close inspection shows the skin of the face yellow and wrinkled, with a suggestion of old age, altogether at variance with an otherwise boyish appearance. It is, of course, true that by no means all of the victims of this malady exhibit such terrible effects of the infection, but even where the worms are gotten rid of comparatively early a failure to develop and a scanty beard are apt to remain throughout life. Notwithstanding the serious character of this malady the prognosis is good if its true nature be discovered, and the proper remedies applied. Recovery almost invariably follows where the parasites are expelled, but convalescence is always slow,— it usually requiring from six to eight months for the sufferer to regain his normal health. The prophylaxis is simple. All that is necessary is for the stools to be passed in a properly constructed water closet, and adequate means taken to prevent the feces being scattered about the premises. Those living in hookworm districts should be instructed as to the danger of children deficating in the horse-lot, in the garden and in other places in the neighborhood of their houses,— a habit very common among the negroes and poor whites in the backwood districts of the South. Likewise the curing of those infected is of the first importance, as so long as they have the disease they are a constant source of danger to those with whom they live. The treatment is also very quick and simple. The day before the treatment is to be given the patient must take no evening meal. It is good practice to give at bed time a dose of some good purgative, such as calomel or castor oil, and if it does not act well before morning a saline laxative should be administered as soon as the patient awakes. After the bowels act well the real treatment for expelling the worms is taken; of such drugs we have several. Perhaps the best and safest is oil of chenopodium, either alone or combined with 10 drops of chloroform with each dose; the medicament is given in two portions, one hour apart; the amount usually prescribed is in the ratio of two drops to each year of life up to 24, after which the quantity is not increased. Another excellent remedy for hookworm is thymol; it is very important to have the drug finely powdered; it should also be administered in two doses at an interval of an hour,— the quantity being about two and a half grains to each year of life of the patient, but is not increased after the 24th year. As this drug is poisonous, and has in a few instances caused death, it should be given with a great deal of care. In using it for the treatment of hookworm disease it should be remembered that the object is to cause it to lie in the intestine in contact with the worms just sufficiently long for it to kill or stupefy them, but to prevent its being absorbed into the circulation of the patient as far as is possible. Therefore we should give nothing that would dissolve the medicament, such dissolvents are: alcohol and anything containing it; butter and all oils; and, since thymol is slightly soluble in water, fluids and drinks of all kinds in greater quantities than absolutely necessary so long as the drug remains in the patient's intestine. For the foregoing reason it is perhaps as well not to give castor oil in any stage of the treatment where thymol is to be used to expel the worms. In addition to the foregoing beta-naphthol, the oleoresin of the male fern, oil of eucalyptus and several other drugs are sometimes given in the treatment of hookworm, but the results with the two agents first mentioned are so much superior that it is useless to go into details of their administration. Whatever the drug that is used to expel the worms it is well for the patient to have a suitable laxative some hours after it is given, he should remain in bed during the entire day that the treatment is administered, and should take no food until late in the afternoon. After the worms are expelled nothing but good food is, as a rule, necessary, but it is thought by some that the administration of tonics, especially those containing iron and other supposed blood-builders, is of benefit. The treatment of ground itch consists in keeping the parts cleaned and protected from external injury, together with some antiseptics and soothing ointment.

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HOONOOMAUN, hoo'noo-măn. See Entellus Monkey.

HOOP ASH. The black or water ash (*Fraxinus nigra*). See Ash.

HOOPER, hûp'ėr, **John,** English reformer and martyr: b. Somersetshire, about 1495; d. Gloucester, 9 Feb. 1555. He embraced the principles of the Reformation and in 1539, to avoid the persecution consequent on refusing to sign the new articles of faith put forth by Henry VIII, withdrew to the Continent. On the accession of Edward VI in 1547, he went to London and contributed greatly to the progress of the Reformation. In 1550 he was nominated bishop of Gloucester. On the accession of Mary, in 1553, he was one of the first victims fixed upon, and being imprisoned in the Fleet, was treated with great severity. In 1555 he was required formally to recant his opinions. This he refused to do and was burned at the stake near his own cathedral. His works consist chiefly of a 'Godly Confession and Protestation of the Christian Faith'; 'Lectures on the Creed'; 'Sermon on the Book of Jonah'; 'Annotations on the Thirteenth Chapter of the Romans.'

HOOPER, William, American patriot: one of the signers of the Declaration of Independence: b. Boston, Mass., 17 June 1742; d. Hillsboro, N. C., October 1790. He was graduated at Harvard College in 1760, studied law with James Otis in Boston and removed permanently to Wilmington, N. C., in 1767, where he soon rose to professional eminence and was noted for his social qualities and hospitality. He was delegated to the Continental Congress in 1775, and was till his death a leader in the councils of North Carolina.

HOOPESTON, hoops'tọn, Ill., city in Vermilion County, on the Lake Erie and Western and the Chicago and Eastern Illinois railroads, about 85 miles south of Chicago and 48 miles south by east of Kankakee. It has a Carnegie library, several public parks and is the seat of Greer College, established in 1891. It is situated in an agricultural region and its chief industries are connected with agricultural products. It has large sweet-corn canning establishments and factories for making the cans and the canning machinery. There are manufactured other canned goods, also horseshoe nails, gas engines and agricultural implements. Grain and hay are shipped to the larger markets. The government, in accordance with the charter of 1877, is vested in a mayor who serves for two years and in a city council. The city owns and operates the waterworks. Pop. 4,698.

HOOPING-COUGH, a series of coughs ending in a long-drawn breath, during which a shrill whistling sound, the hoop, is produced. Several fits of coughing succeed one another until some phlegm or mucus is expelled. Vomiting not infrequently follows a fit of coughing. It has recently been discovered that the cause of the complaint is a poison acting as an irritant on the pneumogastric nerve. Hooping-cough is contagious and most commonly attacks children, generally but once in their lives. The first symptoms are a difficulty of breathing and other slight febrile affections, which are succeeded by hoarseness, cough and difficulty of expectoration. After a fortnight or more the cough becomes convulsive and is attended by the hoop. In four or five weeks the expectoration becomes loose and the fits of coughing gradually diminish in frequency and duration. Hooping-cough is seldom fatal to adults, but is most fatal in the first year of childhood. Bronchitis and pneumonia are the most serious complications.

HOOPOE, hoo'pō, a peculiar bird of the Old World, which takes both its vernacular and scientific name (*Upupa*) from its whooping cry. It is of the group *Coccygomorphæ* (q.v.) and represents a family (*Upupidæ*), many species of which inhabit southern Asia and Africa, while one (*U. epops*) is a well-known migrant in Europe. It is about 12 inches long, is brown above and white beneath, with black, white-barred wings and a very large cinnamon-red black-tipped crest and a long, sharp, curved bill. It seeks its food on the ground, nests in holes in trees, crannies in walls, etc., and has many curious traits and habits which have caused the bird to take a prominent place in the folklore of all countries. The African hoopoes belong to the genus *Irrisor* and are called wood-hoopoes. They have brilliant plumage but no crest. They go about in noisy flocks and have much the appearance and habits of woodpeckers.

HOORN, hōrn, or **HOORNE,** hōr'nė, or **HORN,** or **HORNES,** ŏrn, Count of (Philip II, De Montmorency-Nivelle), Flemish soldier and statesman: b. about 1520; d. Brussels, 5 June 1568. His father was a descendant of the French family of Montmorency, and on the mother's side he was related to Lamoral Egmont, with whose fate his own was linked. His mother became a widow when he was about eight, and was married again to John, Count van Horn, one of the wealthiest nobles of the Netherlands, who left his estates to his wife's children on condition that they should assume his name. Philip was thus at the outset of his career one of the most influential of his order, and received from Charles V and Philip II important trusts and distinctions. He accompanied Philip II to Spain, where he is supposed to have received information of the designs of the Spanish court against the Netherlands and to have communicated them to the Prince of Orange. Returning to the Netherlands he joined Orange and Egmont in resisting the aggressive policy of Philip; yet continued loyal to the Crown. He was, however, suspected by the Spanish court, and upon the arrival of Alva in Brussels was enticed with Egmont to that city, and arrested in September 1567, on a charge of high treason. Ceaseless but vain efforts were made to obtain for him a fair trial, and appeals for clemency on his behalf were made by potentates in all parts of the Continent. He was executed with Egmont in June 1568. Consult 'Cambridge Modern History' (Vol. III, 1905).

HOOSAC (hoo'sąk) **MOUNTAIN,** the name given to a spur of the Green Mountains which is in the northwestern part of Massachusetts, on the east side of the valley of the Hoosac River; maximum altitude 2,400 feet. The whole length is about 16 miles. The mountain is noted for its beautiful scenery.

HOOSAC TUNNEL, in the towns of Adams and Florida, in Berkshire County, in Massachusetts, and piercing the Hoosac Mountain. It is on what is now known as the Boston and Maine Railroad, the route from Boston to Troy, N. Y., by way of Greenfield. From the west entrance of the tunnel to Troy is 54 miles; from the east entrance to Boston, 137 miles. The tunnel is nearly five miles in length, the longest tunnel in the United States and with the exception of the Rogers Pass tunnel in British Columbia the longest on the continent. Before the general introduction of railroads, and, as early as 1825, the project was broached of making a canal across Massachusetts from Boston to the Hudson River. This plan was abandoned when railroads were built across the State. In 1851 the tunnel question had advanced so far that surveys of various routes were made and some experiments were begun. The work of tunneling began in 1856 and was completed in 1873. For so long a tunnel the ventilation is good owing to the shaft, 1,028 feet, sunk near the centre. The width is sufficient for two tracks. The total cost, including 39 miles of adjoining railroad, was about $13,000,000.

HOOSICK FALLS, N. Y., village in Rensselaer County, on the Hoosick River and on the Boston and Maine Railroad, about 28 miles northeast of Albany. The first permanent settlement was made in 1688, and the first charter was received in 1827. The charter has been revised and the last revision was in 1890. The village has excellent water power. The chief manufactures are agricultural implements, paper and paper-making machinery, electric insulators, shirts, cotton and woolen goods and flour. The government of the village is vested in a president who holds office three years, and a board of trustees. The site of the British entrenchments at the battle of Bennington, 6 Aug. 1777, is near here and is now maintained as a State park. The waterworks are the property of the village. Pop. 5,532.

HOOSIER SCHOOLMASTER, The. In the conclusion to the 'Hoosier Schoolmaster' Edward Eggleston announces his belief that readers whose taste is not perverted always want a story to «come out well.» Accordingly he so planned this his first and most important romance that the lovers are all happily united, the poor orphans become prosperous and the evil-doers receive just punishment, mitigated somewhat through the generous intervention of those whom they have wronged. The 'Hoosier Schoolmaster' owes its great popularity not so much to the conventional plot as to its happy description of early days in Indiana. It pictures the country school in which custom prescribed a constant warfare between the master and the big boys, the community spelling-school, the different forms of bigoted and illiterate preaching that were offered to the new settlers, the amusing attempts at formality in the proceedings of the courts, and other features of pioneer life as the author had seen them in his career as itinerant missionary and agent for a Bible society. Eggleston's fondness for historical accuracy sometimes led him to sacrifice the artistic unity of his story in order to introduce a detail exactly as it was found in real life, but this defect is less noticeable in the 'Hoosier Schoolmaster' than in some of his later novels. There is a great variety of characters who, while they are drawn pretty much in unshaded black and white, have enough truth to human nature to seem real. A sufficient humor pervades the whole, the action never drags and the book despite its limitations deserves the great vogue it has had since its publication in 1871.

William B. Cairns.

HOOSIER STATE, a popular name for Indiana. The word is said to be a corruption of «husher,» formerly a colloquial name for a fighter or a bully.

HOOVER, Herbert Clark, American engineer and public official: b. West Branch, Iowa, 10 Aug. 1874. He was graduated at Stanford University, California, in 1895, was assistant on the Arkansas geological survey in 1893 and the United States geological survey of the Sierra Nevada in 1895. In 1896 he was assistant manager of the Carlisle mines, New Mexico, and the Morning Star mines, California. In the following year he went to West Australia as chief of the mining staff of Bewick, Moreing and Company and manager of Hannan's Brown Hill mine. In 1899 he was chief engineer of the Chinese Imperial Bureau of Mines and performed extensive exploration in the interior of China. He took part in the defense of Tientsin during the Boxer disturbances of 1900. From 1900 to 1914 he served successively as general manager, director and partner of various mining companies. In 1915–16 he served as chairman of the American Relief Committee in London and went to Belgium as chairman of the Commission for Relief in Belgium. Under his direction millions of dollars worth of food and clothing were distributed to the needy in devastated Belgium. His efficient record in this position led to his appointment in 1917 by President Wilson as food controller for the United States. See Food Problems and the War.

HOP-HORNBEAM. See Iron-wood.

HOPATCONG, hō-păt'kŏng, **Lake,** in Morris and Sussex counties, New Jersey, about 33 miles northwest of Jersey City and 25 miles west of Paterson. The lake is 725 feet above the sea, and eight and one-half miles long and three and one-half miles wide. Its area is 2,443 acres. Its outlet is the Musconetcong River which flows into the Delaware, but it is also the source of supply for the upper level of the Morris Canal, through which some of its waters pass into the Rockaway River. Lake Hopatcong is a favorite summer resort, its beautiful scenery being one attraction. It is surrounded by hills and low mountains, all well wooded, and many of the trees are evergreens.

HOPE, Anthony. See HAWKINS, ANTHONY.

HOPE, Ascott R. See MONCRIEFF.

HOPE, Ark., city of Hempstead County, 115 miles southwest of Little Rock, on the Saint Louis and San Francisco, the Louisiana and Arkansas, and the Saint Louis, Iron Mountain and Southern railroads. Situated in a cotton and fruit-growing region it has cottonseed-oil mills, compresses, planing and lumber mills, cotton gins, wagon works and box, spoke, stave and handle factories. The waterworks, electric lighting and sewage disposal plants are owned by the city. Pop. 3,639.

HOPE COLLEGE, in Holland, Mich., coeducational institution, founded in 1866 by Dutch settlers, and under the auspices of the Reformed Church in America. The Western Theological Seminary was founded in 1869. It maintains a preparatory school. The campus comprises 16 acres. Five courses are given — classical, philosophical, natural science, modern language English and mathematics. The degree of B.A. is conferred. At the close of 1915 there were connected with the school 23 instructors and 400 students. The library contained 21,000 volumes. The income amounts to about $36,000 annually, and the endowment to $388,000. The principal buildings are the Carnegie Gymnasium, Graves Library, Van Raalte Memorial Hall, the Ackerman Hoyt Observatory and the Winants Chapel.

HOPE DIAMOND, a famous blue diamond weighing 44¼ carats, in possession of the family of H. T. Hope, of England, until 1903, when it was sold to an American.

HOPEDALE, the name of a community founded by Rev. Adin Ballou, in 1841, at Milford, in Worcester County, Mass. At the beginning there were 28 persons who wished to lead lives in accordance with high ideals of Christianity. They formed themselves into a joint-stock company, purchased a farm of 238 acres, established a settlement, and proceeded to cultivate the soil, and to manufacture their own breadstuffs and clothing. At first a board of trustees were the chief governing power and had entire control of the industries. Later more responsibilities were given to the members, and the industries were, in different ways, apportioned among them. In 1854 there were 200 members; but the community had become a financial failure and dissensions had crept in. In 1856 they were in debt, and as a joint-stock company they disbanded; but continued as a semi-communistic community until about 1862, when they gave up the industries they had established to private individuals, and formed themselves into Hopedale Parish with their founder as pastor. Consult Ballou, Adin, 'Hopedale Community.'

HOPKINS, Alphonso Alvah, American author and lecturer: b. Burlington Flats, N. Y., 27 March 1843. He was for three years professor in the American Temperance University; from 1867–86 was editor of three agricultural papers successively. Since 1868 he has lectured on temperance and other social and political subjects; in 1882 he was the prohibition candidate for governor of New York. He is editor of the *National Advocate*. He has written 'Geraldine, a Romance in Verse,' a popular poem in the style of Owen Meredith's 'Lucille' (1881); 'His Prison Bars' (1878); 'Sinner and Saint' (1880); 'Life of General Clinton B. Fisk' (1888); 'Wealth and Waste' (1896); 'Ballads of Brotherhood' (1900); 'Profit and Loss in Man' (1909); 'The Bugle of Right' (1913).

HOPKINS, Edward, American colonial governor: b. England, 1600; d. London, March 1657. He was a prominent merchant of London, and came to Boston in 1637, but soon after removed to Hartford, where he was chosen a magistrate in 1639, and governor of the colony of Connecticut every other year from 1640 to 1654, alternating with Haynes. He afterward went back to England, where he was chosen warden of the English fleet, commissioner of the admiralty and navy and member of Parliament. But he never lost his interest in the colonies, and at his death bequeathed much of his estate to New England, giving £1,000 for the support of grammar schools in Hartford and New Haven, which are still flourishing, and £500 which went to Harvard College and the grammar school at Cambridge.

HOPKINS, Edward Washburn, American philologist: b. Northampton, Mass., 8 Sept. 1857. He was graduated from Columbia in 1878, and going to Germany to study took the degree of Ph.D. at the University of Leipzig. He taught at Columbia (1881–85) and at Bryn Mawr (1885–95). In 1895 he became professor of comparative philology and Sanskrit at Yale. He is a member of American Philosophical Society, American Academy of Arts and Sciences, American Oriental Society, German Oriental Society, Royal Asiatic Society, etc. He has written 'Caste in Ancient India' (1881); 'Manu's Lawbook' (1884); 'Religions of India' (1895); 'The Great Epic of India' (1901); 'India Old and New' (1901); 'Epic Mythology' (1915); besides numerous papers on philology and Hindu history. For 10 years he was editor of the *Journal of the American Oriental Society*, of which he became president in 1908.

HOPKINS, Esek, first commodore of the American navy: b. Scituate, R. I., 1718; d. North Providence, R. I., 26 Feb. 1802. In November 1775 he received a commission from the Continental Congress as commodore and "commander-in-chief" of the navy, soon after which he put to sea with the first squadron sent out by the colonies. The fleet sailed for the Bahama Islands, and captured the forts at New Providence, and with them 80 cannon and a large quantity of ordnance, stores and ammunition. On his return, when off Block Island, the commodore took the British schooner *Hawke* and the bomb brig *Bolton*. For this act the president of Congress complimented Hopkins officially. Commodore, or Admiral Hopkins, as he was generally called (even by Washington, who so addressed him in his official letters), performed other remarkable exploits, though he had great difficulties to contend with. His name became a synonym for heroism and for American patriotism. In June 1776, Hopkins was ordered by Congress to appear before the naval committee in Philadelphia to reply to charges which had been preferred against him for not annoying the enemy's ships on the southern coast. He was defended by John Adams, and was acquitted. The unavoidable delays at a later period in getting his ships ready for sea gave another chance for his enemies to complain; and neglecting a citation to appear at Philadelphia, because no specific charges were made against him, and on account of his general disgust at the conduct of his opponents, he was dismissed the service, 2 Jan. 1777. He resided near Providence and exerted during a long life a great political influence in Rhode Island, being often elected to the general assembly of that State. Consult Field, ‹Esek Hopkins› (1898).

HOPKINS, Ezekiel, bishop of Londonderry: b. Pinne, Devonshire, 3 Dec. 1634; d. Aldermanbury, 19 June 1690. After being graduated at Oxford he became chaplain of Magdalen College in 1656. After conforming to the Church of England he became incumbent of the parish of Saint Mary Woolnoth at London. The great plague drove him to Exeter, where he remained until 1670, when, through the prestige of Lord Robartes, lord lieutenant of Ireland, he obtained the deanery of Raphoe, and in the following year the bishopric of that district. He was appointed bishop of Londonderry in 1681. His office terminated in 1689 with the siege of the town by the Irish supporters of James II. Returning to London, he became rector of Saint Mary, Aldermanbury (1689). His published works include ‹Sermons›; ‹Expositions of the Decalogue and the Lord's Prayer›; ‹Regeneration›; and ‹The Vanity of the World.› These have been edited best by Pratt (4 vols., London 1809).

HOPKINS, John Henry, American Protestant Episcopal bishop: b. Dublin, Ireland, 30 Jan. 1792; d. Rock Point, near Burlington, Vt., 9 Jan. 1868. At the age of eight, he was brought to America, his father settling in Philadelphia. He became a successful member of the bar in Pittsburgh, where his interest in church work was so earnest that the vestry of Trinity Church unanimously elected him rector of the parish though he was not even a candidate for orders. He accepted the call, was ordained in 1823, and remained in Pittsburgh until 1831, when he went to Trinity Church, Boston, as assistant, and became at the same time professor of systematic divinity in a theological school. He was consecrated bishop of Vermont in 1832 and combined with the episcopate the rectorship of Saint Paul's Church, Burlington. Though at the head of a small diocese, he exerted a widespread influence as a learned theologian and a controversialist of uncompromising bravery and great versatility. He is said to have been the first to suggest the idea out of which grew the important Lambeth Conferences of the entire Anglican Communion, and it is unquestionably to his prudent and charitable efforts that the happy reunion of the Northern and Southern dioceses after the Civil War was largely due. Besides controversial works, which at the time had great effect, he published ‹The Primitive Creed› (1834); ‹The Primitive Church› (1835); ‹The American Citizen› (1857); and ‹The Law of Ritualism› (1866). See ‹Life of Bishop Hopkins by One of his Sons› (1873).

HOPKINS, Johns, American financier and philanthropist: b. Anne Arundel County, Md., 19 May 1795; d. Baltimore, 24 Dec. 1873. His parents, Quakers, gave him a fair education and the training of a farmer. At 17 he went to Baltimore, there became a grocer, and in 1822 founded the house of Hopkins and Brothers. He built up a trade in Maryland, Virginia and North Carolina, having practically a monopoly in his line. His credit and counsel were highly valued in financial and mercantile affairs. He retired in 1847 with a large fortune, which he employed in banking and railway operations. In 1873 he gave property worth $4,500,000 to found a free hospital; he presented Baltimore with a public park, and also gave over $3,000,000 to found the Johns Hopkins University in Baltimore.

HOPKINS, Lemuel, American physician and political writer: b. Waterbury, Conn., 19 June 1750; d. Hartford, Conn., 14 April 1801. He practised medicine at Litchfield 1776-84, when he removed to Hartford, where he sustained a high reputation, and had an extensive practice till his death. He was singular in his appearance, manners and opinions; a man of talents and learning, and also a poet. He was associated with Trumbull, Barlow, Alsop, Theodore Dwight and others (called the «Hartford wits»), in the ‹Anarchiad,› ‹Echo,› ‹Political Greenhouse,› ‹Guillotine,› and other similar satirical compositions; and is said to have written for Barlow the beautiful and well known version of the 137th psalm beginning, «Along the Banks where Babel's Current Flows.»

HOPKINS, Margaret Sutton Briscoe, American author: b. Baltimore, 7 Dec. 1864. She married Prof. A. J. Hopkins of Amherst College, and has been engaged in literary work since 1890. She has written under the pen name of «MARGARET SUTTON BRISCOE» ‹Perchance to Dream and Other Stories› (1892); ‹Links in a Chain› (1893); ‹Jimty and Others› (1898); ‹The Sixth Sense and Other Stories› (1899); ‹The Change of Heart› (1903); ‹The Image of Eve› (1909).

HOPKINS, Mark, American college president: b. Stockbridge, Mass., 4 Feb. 1802; d. Williamstown, Mass., 17 June 1887. He was graduated at Williams College, Massachusetts in 1824, and having filled a tutorship in the college two years received in 1828 the degree of M.D., and in the same year commenced the practice of medicine in New York. In 1830 he was recalled to Williams College to fill the chair of moral philosophy and rhetoric, and in 1836 became president of the college, a position which he held till 1872. In addition to his labors as an instructor, he lectured before the Lowell Institute of Boston, the Smithsonian Institution and various scientific and literary associations. Presiding over a college which has been called the cradle of foreign missions, he took an active part in the deliberations of the American Board of Commissioners for Foreign Missions, of which he was president from 1857. He published 'Lectures on the Evidences of Christianity' (1846); 'Miscellaneous Essays and Discourses' (1847); 'Lectures on Moral Science' (1862); 'The Law of Love and Love as Law' (1869); 'Outline Study of Man' (1873); 'Scriptural Idea of Man' (1883); 'Teachings and Counsels' (1884). Consult Carter, 'Life of Mark Hopkins' (1892).

HOPKINS, Pauline Bradford Mackie, American novelist: b. Fairfield, Conn., 6 July 1874. In 1899 she married H. M. Hopkins, who died in 1910; she has been in literary work since 1896. Her works include 'Mademoiselle de Berny, a Story of Valley Forge' (1897); 'Ye Lyttle Salem Maide, a Story of Witchcraft' (1898); 'A Georgian Actress, an Historical Romance' (1900); 'The Washingtonians' (1902); 'The Flight of Rosy Dawn' (1902); 'The Voice of the Desert' (1903); 'The Girl and the Kaiser' (1904); 'The Story of Kate' (1907); and the plays 'Yellow Bird' (1915); 'The Moving House' (1915); and 'The Spell' (1916), with Sarah Jefferis Curry.

HOPKINS, Samuel, American Congregational clergyman: b. Waterbury, Conn., 17 Sept. 1721; d. Newport, R. I., 20 Dec. 1803. He was graduated at Yale College in 1741, studied theology under Jonathan Edwards (q.v.), and in 1743 was ordained at Housatonic, now Great Barrington, Mass., where he continued until 1769, when he removed to Newport, R. I., and was pastor there till his death. He possessed almost incredible powers of application, and is said to have been sometimes engaged during 18 hours of the day in his studies. He published 'Dialogue, Showing it to be the Duty and Interest of the American States to Emancipate all their African Slaves' (1776); 'System of Doctrines Contained in Divine Revelation, Explained and Defended' (1793), etc. His theological opinions gave rise to the famous Hopkinsian Controversy. Hopkins differs from orthodox Calvinism in his opposition to the doctrines of original sin and of the atonement; moreover, he put particular stress on the virtue of altruism and unselfishness, even claiming that selfishness, of whatever nature, was inherently and essentially sinful. Consult West, 'Life of Hopkins' (1805); Park, 'Memoir' (1852). Consult also Mrs. Stowe's novel, 'The Minister's Wooing,' in which Hopkins is the central figure.

HOPKINS, Stephen, American statesman, a signer of the Declaration of Independence: b. Scituate, R. I., 7 March 1707; d. Providence, 13 July 1785. In 1733 at Providence he was elected a member of the general assembly and in 1739 became chief justice of the Court of Common Pleas. In 1755 he was elected governor of the State and remained in office, with the exception of four years, until 1768. In 1754 he was appointed a member of the board of commissioners assembled at Albany, N. Y., to concert a plan of union for the colonies. In 1765 he was elected chairman of a committee appointed at a special town meeting held in Providence to draft instructions to the general assembly on the Stamp Act. In August 1774 he was, with Samuel Ward, elected to represent the State in the general Congress held at Philadelphia and was also chosen in 1775 and 1776. On the naval committee he was placed next after John Hancock, the chairman, and greatly assisted in the formation of a navy. For 50 years he filled some public station; he was for many years chancellor of Brown University. In 1765 he commenced a 'History of the Planting and Growth of Providence,' published in the *Providence Gazette*. In the same year he published 'The Rights of the Colonies Examined,' which was reprinted in London.

HOPKINSON, Francis, American jurist, one of the signers of the Declaration of Independence: b. Philadelphia, 21 Sept. 1737; d. there, 9 May 1791. He was graduated at the College of Philadelphia (now the University of Pennsylvania), having been the first student who entered that institution at its opening, and afterward studied law. In 1776 he was sent from New Jersey as one of her representatives in Congress. During the Revolution he distinguished himself by satirical and political writings, which attained such popularity that it has been said that few pens effected more than Hopkinson's in educating the American people for political independence. He also ridiculed in prose and verse most of the social follies of his time. In 1779 he was made judge of the admiralty of Pennsylvania, which office he held for 10 years, until the organization of the Federal government, when it expired. As soon, however, as Washington became President of the United States, he addressed to Hopkinson a letter enclosing a commission as United States district judge for Pennsylvania. He was skilled in painting and music, composing highly popular airs for his own songs. Of his political writings the most prominent were 'The Pretty Story' (1774); 'The Prophecy' (1776); 'The Political Catechism' (1777). The best known of his poems are 'The Battle of the Kegs,' a humorous ballad, and 'The New Roof, a Song for Federal Mechanics.' The 'Miscellaneous Essays and Occasional Writings of Francis Hopkinson' were published in 1792.

HOPKINSON, Joseph, American jurist and poet: b. Philadelphia, 12 Nov. 1770; d. there, 15 Jan. 1842. He was son of Francis Hopkinson (q.v.). He was educated at the University of Pennsylvania, studied law and began to practise at Easton, Pa., in 1791, whence he returned to Philadelphia. From 1815 to 1819 he was a member of the House of Representatives from Philadelphia. He opposed the recharter of the United States Bank, and made a noted speech on the Seminole War. At the close of 1819 he retired from Congress, declining a re-election. Having gone to Bordentown to reside, he was elected to the legislature of New Jersey. In 1828 he was appointed judge of the United States court for the eastern district of Pennsylvania, an office which had been filled by his father under Washington. In 1837 he was chairman of the judiciary committee of the convention to revise the constitution of Pennsylvania. He is, however, best known as the author of the national song, 'Hail Columbia,' written in 1798 for the benefit of an actor named Fox.

HOPKINSVILLE, Ky., city and county-seat of Christian County, on the Louisville and

Nashville and the Ohio Valley railroads. Here are Bethel Female and Southern Kentucky colleges, Western Kentucky Insane Asylum and manufactures of tobacco, lime, brick, wagons and carriages, a national bank and the Hopkinsville High School. The city has an assessed property valuation of over $2,000,000. Pop. 9,419.

HOPPER, Isaac Tatem, American philanthropist: b. Deptford, N. J., 3 Dec. 1771; d. New York, 7 May 1852. He was a member of the Society of Friends, and in the division which took place in 1827–28 joined the anti-orthodox or «Hicksite» branch. In 1829–41 he was director of a New York shop for the sale of Hicksite books; in 1841–45 was treasurer and book-agent of the Anti-Slavery Society, and from 1845 devoted his efforts to the work of the New York Prison Association. He was widely known for his interest in benevolent objects, especially negro emancipation and the assistance of discharged prisoners. At Philadelphia he was a founder and the secretary of a society for the employment of the poor, teacher in a colored school and otherwise interested in philanthropic measures. He was an eloquent speaker. Consult the ‘Life’ by Child (1853).

HOPPER, (William) De Wolf, American actor: b. New York, 30 March 1858. He made his first professional appearance in ‘Our Boys’ (1878) and later appeared with Daniel Frohman's Madison Square Company as Pittacus Green in ‘Hazel Kirke’ and other plays. He studied vocal music for several years and became a star in comic opera and musical comedy. He was with the Weber and Fields Company for a time and then starred at the head of his own company, playing ‘Mr. Pickwick.’ He again starred in the revivals of ‘Wang’; ‘Happyland’; ‘The Matinee Idol’; and ‘Pinafore.’ In 1912 he appeared as Reginald Bunthorne in ‘Patience’ at the Lyric Theatre, New York, and later as Edward in ‘The Pirates of Penzance.’ In 1913 he played Ko-Ko in ‘The Mikado’ and the Lord Chancellor in the star revival of ‘Iolanthe’ in the same year.

HOPPIN, James Mason, American scholar and author: b. Providence, R. I., 17 Jan. 1820; d. 1906. He was graduated from Yale in 1840, studied law at the Harvard Law School (1841–42), theology at the Union and Andover seminaries (1843–45) and the University of Berlin (1847–49), was ordained to the Congregational ministry in 1850 and was pastor at Salem, Mass., in 1850–59. In 1861–79 he was professor of homiletics at Yale, in 1861–63, also pastor of the college church, and from 1879 until his retirement as professor emeritus in 1899 professor of the history of art. His publications include ‘Notes of a Theological Student’ (1854); ‘Old England: Its Art, Scenery and People’ (1867); ‘The Office and Work of the Christian Ministry’ (1869); ‘Life of Rear-Admiral Andrew Hull Foote’ (1874); ‘Homiletics’ (1881); ‘Pastoral Theology’ (1889); ‘The Early Renaissance’ (1892); ‘Greek Art on Greek Soil’ (1897); ‘The Reading of Shakespeare’ (1904).

HOPS (*Humulus lupulus*) are the strobiles or catkins of a climbing plant, often met with in the wild state in northern Europe and in North America. The hop belongs to the nettle family and it is the sole representative of its genus, but is cultivated in many varieties. It is a diœcious plant, that is, the pistillate (female) and staminate (male) inflorescence are borne by different plants. In American and English hop-gardens it is customary to grow a sprinkling of male plants, but these are rigorously excluded on the Continent. In the former case the pistillate inflorescence becomes impregnated and forms seeds, in the latter they do not. In good hops the seeds are scarce, small, shrunken and sterile, that is, incapable of propagating the plant. Many believe that the formation of seed ought to be prevented, as the seeds are useless to the brewer, the main consumer of hops, and besides they only add weight to the hops, and this, indeed, is the chief reason for growing them. Their presence, however, grades the hops to a lower price so that the net result is a loss.

The hop is a perennial herbaceous plant, which produces each year several long, twisting, striated stems, 15 to 30 feet in length, which clamber over hedges, brush, etc., with ease. The leaves are stalked, opposite, generally three lobed (sometimes five- to seven- lobed) and coarsely dentate. They are, like the stem, rough to the touch. The male inflorescence forms a panicle; the flowers enclose five stamens in a small greenish five-parted perianth. At an early stage the female inflorescence is less conspicuous. The strobile or catkin consists of several small acute bracts or leaves at whose base are situated two sessile ovaries, each subtended by a rounded bractlet. These bracts are one-half to three-quarters of an inch long and are attached to the extremity of the stem in such a way as to lap and form a cone.

The ovary and the base of the bracts are covered with a yellowish powder, the «hop-meal» or lupulin, which is the active principle of the plant.

Hops contain hop-oil, hop-resins, acids, hop-tannin, hop-bitter, hop-wax, nitrogenous bodies, carbohydrates and mineral substances. Diastase (an enzyme) has also been found, which is especially valuable in ale brewing. Hop-oil, the principal constituent of the lupulin, present in 0.2 per cent to 0.8 per cent, is obtained by distilling the hops with water. It is colorless and hardly soluble in water. The characteristic agreeable aromatic flavor of the hops depends on this oil. If exposed to air the oil turns to resin, passing to valerianic acid, to which the cheesy odor of old hops can be traced. According to Hayduck, there are three resins in hops, the α β and γ, of which the first two are soft and the latter hard. The preserving, antiseptic effect of hops is due to the two soft resins, as they are distinctly prejudicial to the growth of butyric acid and many other bacteria, but do not have much effect on acetic acid bacteria and sarcina. In old hops valerianic acid, malic acid, citric acid and succinic acid are present. Hop-tannin is chiefly stored in the leaves of the strobile and is a pale brown amorphous powder soluble in dilute alcohol, which through oxidation passes into phlobaphen. The hop-bitter is obtained from the two soft resins, and imparts a pleasant bitter taste to the beer, without which it would be flat and insipid. They are present in the dry hops up to 15 or 17 per cent. Hop-wax is present in considerable proportions in hops, but, since it is insoluble in water and even in 90 per cent alcohol, it has no value in beer. Nitrogenous constituents of hops are about 2 per cent to 4 per cent, which calculated to albumen are 12 per cent to 24 per cent, of which 0.75 per cent to 1.6 per cent are soluble. Bungerer maintains that 30 per cent of the nitrogenous substances are asparagin. Behrens says that trimethylamin and free ammonia are also present. Griess and Harrow have discovered cholin in hops. Brown and Morris have shown the presence of an enzyme similar to diastase, which will saccharify starch, that is, change it into sugar. This enzyme is chiefly accumulated in the seeds. The carbohydrates contained are cellulose, sugar, dextrin. According to Brown and Morris there is present 1.55 per cent dextrose and 2.10 per cent levulose, together 3.65 per cent of inverted sugar. According to Thausing hops contain 5.3 per cent to 15.3 per cent of ash and an average of 7.54 per cent, of which over one-third is potash, one-sixth phosphoric acid, one-sixth silica, and some sodium, lime, magnesia, iron oxide, sulphuric acid and chlorine. The presence of an alkaloid in the seed has been ascertained by Dr. Ernst Hantke, but research on this point is still progressing.

Only a very small amount of hops is used in medicine, being chiefly employed as a stomachic in dyspepsia; a pillow stuffed with hops is said to induce sleep. By far the largest portion of the hops produced is used in the manufacture of various beers, so that here this subject is treated with that idea in view.

For about 1,000 years hops have been added to beer or wort, to give it its pleasant and characteristic flavor and aroma; and their cultivation has progressed as the manufacture of beer became widespread. Germany and England had hop gardens in the 8th and 9th centuries, but the cultivation was not nationalized until the 16th century, and at present hops are a very important agricultural product.

The pistillate plant alone is cultivated on the Continent, especially Germany and Austria, because the hop growers there find that unfertilized pistillate plants produce strobiles richer in aroma, more plenteous in lupulin, and in general better than where the plants were fertilized through the pollen of the staminate plant. In the United States we always find the strobiles containing much seed, while the choice imported Bohemian and Bavarian hops are seedless. The pistillate plant flowers in August, and its strobiles are ready for harvesting during September.

The continental European growers always strive to have early, medium and later hops, so that there the hop-picking begins late in August and lasts through the early part of October. In the United States the picking is usually over in two to three weeks. Much loss can occur by too early picking, while too late harvesting is also detrimental to the value and quality of the product.

Abroad the finest hops are raised in Bohemia, its «Saazer» hops being known throughout the world. Next to this ranks the Bavarian «Spalter hops,» and the product of the so-called «Hallertau.» As a rule the Bavarian hop is stronger than the Bohemian, but somewhat inferior in quality. Würtemberg, Saxony, Baden, Prussia and Alsace also raise a good quality of hops; and Belgium, northern France and Burgundy cultivate it on a large scale. England's most famous hops are the «Farnhams,» the «Golony» and «Grape» varieties. Owing to the high import taxes, Russia is also raising hops. Of all these only the «Saazer» and the «Spalter» are imported to the United States.

The world's production of hops in the year 1913 (the latest normal figures available) amounted to 173,936,914 pounds, about 21,000,000 pounds less than the average, and 50,556,372 pounds less than the preceding year. This deficiency in 1912 was due chiefly to a shortage of 25,000,000 pounds in the Austrian crop, 22,000,000 pounds in the German crop and 13,000,000 pounds in the English crop. This was partly made up by an increase of 13,000,000 pounds in the crop of the United States. The production by countries in 1913 was as follows: United States, 62,898,718 pounds; United Kingdom, 28,631,792 pounds; Germany, 23,408,272 pounds; Austria, 23,314,733 pounds; Russia, 16,973,016 pounds; France, 8,028,492 pounds; Belgium, 7,395,231 pounds; Australia, 2,078,100 pounds; Canada, 1,438,459 pounds.

Although hops may be grown generally throughout the United States, their production is limited to a very few sharply defined areas. Nearly the whole annual crop is grown in Oregon, California, New York and Washington. Small quantities are reported from Wisconsin, Idaho, Massachusetts, Pennsylvania, Michigan, Vermont, Kentucky and Ohio. They do not thrive where the winters are long or severe, and they are dependent in large degree upon the rainfall, a wet season at the time of ripening being disastrous. Hops require bulky nitrogenous manure, and it is the approved practice to manure heavily with stable manure, and to add generous dressings of chemical fertilizers. The crop takes from the soil per acre 129 pounds of nitrogen, 86 pounds of phosphoric acid and 132 pounds of potash. Of these substances 56 pounds of nitrogen, 30 pounds of phosphoric acid and 54 pounds of potash are contained in the hops, and definitely removed from the soil, the remainder being in the stems which can be returned. These figures show that the hop requires twice as much fertilizer as the usual crop of wheat. As the roots run very deep subsoil cultivation is required for the best success.

The hop does not come true from seed, so the commercial crop is grown from cuttings of the «root» (really the underground stem) called «sets.» Planting is done as early in the spring as the soil can be had in mellow condition — in January and February in California, in March in Oregon and Washington, in April in New York. The «hills» are placed from 6½ to 7 feet apart both ways; that is, from 1,031 to 889 hills to the acre. Three cuttings are set to the hill to grow — a fourth is sometimes set to ensure three vines, in case one should be lost. The top bud on the cutting should be placed at two inches below the level of the surface or at the level if the plant is to be hilled up. The price of such sets ranges from $1 per thousand when plentiful to $10 per thousand when scarce. The field is thoroughly cultivated from the time the plants start into growth until they are well branched out, weeds being scrupulously kept down. The number of shoots allowed to grow is limited to 9 or 10 to the hill, the other shoots starting being pruned out. The most vigorous ones are left to grow. Some growers cut away the shoots from the top buds (after these have aided the plant to make roots), claiming that a sturdier growth and a larger yield of hops is gained from the deeper buds. The former use of poles has been very largely abandoned in favor of wire trellises. The high trellis is most in favor, the posts being 20 feet high (set two feet into the ground) and six or seven hills apart. A stout wire is carried over the tops of the posts, and to these are fastened strings carried up from pegs set into the ground at each hill. The upper third of each of these strings is of twine strong enough to carry at least 80 pounds. In some hop yards wires are used instead of strings, and are fastened into S-hooks at the top, so as to be readily unhooked and thrown down to the pickers at harvest time. The low trellis has posts eight feet high set every third or fourth hill. As the hop vine will not run horizontally, a good deal of extra labor is required with the low trellis in training the vines by hand along the top wire. Where the pole system is still in vogue it is common practice to set a pole at each hill, and to run twine from a point on each pole five or six feet above the ground across to the tops of the adjacent poles. This is known as the arbor method. To be of first quality hops have to be picked when just ripe. It is customary therefore to grow several varieties with different periods of ripening, stretching over three or four weeks, so as to work the staff of pickers to the best advantage. Hops generally, but not always, acquire a yellowish hue when ripe. A better test is the texture: when the hops give a crisp rustling sound when crushed in the hand they are “ripe.” At this time also they give out their characteristic odor. Hops are cured by drying until the 75 per cent of water in the newly gathered hops is reduced to 10 to 14 per cent. This is done in kiln houses where they are submitted to an airblast of from 110° to 140° F. They are then fumed with sulphurous acid gas to improve their color and keeping qualities, and are then cooled and pressed into bales. If not immediately marketed, they are placed in cold storage where they may remain in perfect condition for 15 to 18 months — perhaps longer. Sulphured hops keep well for a time even if not put in cold storage, and when unsulphured seem to preserve their freshness if so stored, but unsulphured hops not stored in the cold will soon deteriorate and become strong and musty.

In California, the hop will yield the first year the fields are planted; in New York no crop is secured until the second year. For winter protection in New York State it is customary to place a large forkful of strawy stable manure over each hill.

The cost of producing hops is about 10 to 12 cents per pound. The price they bring varies enormously, from 12 cents up to 50 or 60 cents, and sometimes over $1 per pound. In times of extreme scarcity the prices have been fabulous.

The hop plant is subject to many diseases, due mostly to parasites, among which are the hop plant-louse (*Phordon humuli*), the hop-grub (*Gortyna immanis*), the hop-vine snout-moth (*Hypena humuli*), the hop-merchants (*Polygonia interrogationis*), the zebra caterpillar (*Mamestra picta*), the common woolly bear caterpillar (*Spilisonma virginica*), the saddle-back caterpillar (*Empretia stimulea*), hop-vine leaf-hopper (*Tettigonia confluenta*); various beetles, the “red spider” or spinning mite, and the needle-nosed hop-bug (*Calocoris fulmomaculatus*), which mostly produce red smut, etc., and even destroy entire crops. Fungus pest, blight and mold (black smut), are extremely rare in the United States, although widespread in England and Europe. Within the last few years the hop fields of New York have been devastated by the “powdery mildew” or “blue mould,” a fungus imported from Europe. This pest thrives in rainy weather, and if allowed to gain headway quickly ruins the fields. It has been measurably controlled by spraying dry flowers of sulphur, or finely ground sulphur flour among the plants at intervals: (1) before any signs of the mildew appear, about the time of the second tying; (2) when the hops are well up on the poles; (3) when the hops are in full bloom; and two sprayings later if needed. The amount of sulphur used for each spraying is about 50 pounds per acre. Should the pest be very severe, 70 pounds are used. The best remedies for the destruction of the animal parasites is the use of bisulphide of lime or a heavy spraying of soap and tobacco emulsion. Sulphur in any form is a good remedy, and a spray of kerosene soap emulsion, to which a small quantity of flowers of sulphur is added, is generally effective. In extreme cases the affected plants are cut down and burned to prevent a spread of the disease.

The elements also play havoc with the development of the tender hop-vine. High winds will tear the vine from its support; drouth will tend to change the color of the light yellow strobile to the objectionable “pole redness”; and too much water will result in a lack of lustre, when the hops are said to be “blind.” This is due to the fact that the entire energy of the plant is spent in the formation of leaves, the strobile being imperfectly developed.

Although it is possible to estimate with a fair degree of accuracy the several constituents of hops, it has not been so far found possible to establish any definite relation between the value of the hops and the amounts of hop-oil, resins, tannin, etc., which they contain. Consequently up to the present time, chemistry has not afforded much assistance in this direction. Hence the value of hops is still judged according to its general properties. The color, size and appearance and lustre of the strobile, the quantity and color of the lupulin, the amount of seed, the odor, taste and cleanliness, are the essential points in the valuation of hops.

Fine hops possess a silky lustre which is lacking in inferior grades. The color is greenish yellow, varying with the origin. New York hops have a somewhat paler color of a stronger greenish shade, while the Pacific coast hops have a more pronounced yellowish color. A reddish tint may indicate pole-redness, or, what is worse, that the hops have become overheated in the bale, which implies a darker coloration of the lupulin and deterioration of quality. The form and size of the strobile is also characteristic of the origin. Small strobiles are preferable to big ones, as they contain on an average more lupulin; and the fewer the seeds the better. The bracts ought to lap over one another and hold firmly together, whereby the lupulin is kept in better. The odor and aroma should be strong, fine, free from any off-smell such as odors of fruit, garlic, etc. Only very slight amounts of stems, foliage or stripped cones should be present, as they impart a coarse taste to the beer. The amount of lupulin present in the strobile is an indicator of the value of the hops, because it contains those resins, volatile oils and bitter substances, which are so essentially valuable to the brewer. In fresh hops, slight pressure will force out the contents of the strobile in a transparent droplet, but in old hops the contents of the lupulin granule will not flow, due to resinification, and the expressed juice is more syrupy, wax-like and opaque. The largest part of the German crop is merely air-dried or sun-dried, and it is claimed that this «natural cure» preserves far more of the essential oils and other active principles than is possible by the artificial hot-air cure used in the United States and England, and that this at least in part accounts for the peculiarities of Spalt hops that command such extraordinary prices. Hops are easily affected by warmth, moisture, air and light, and for this reason must be protected in storage against these influences. For brewing purposes it is almost impossible to pass off a substitute for hops, although lupulin and hop-extract are now manufactured. The lupulin is separated from the strobile, and inasmuch as it contains the essential constituents for which hops are used in brewing, it can be better utilized, although it is impracticable and impossible to replace the entire quantity of hops with lupulin alone because it contains very little tannin, which also is essential. The same remark is applicable to hop-extract. The essential oil of hops is another similar preparation. It consists mainly of myrcene and humulene, which constitute from 80 to 90 per cent of the whole, and small proportions of linalool, linalyl *iso*-nonoate, some ester or geraniol and a diterpene.

In the United States, the culture of hops was introduced as early as 1625 in New Netherlands, and 23 years later in Virginia, but although encouraged by special legislation in 1657, never assumed its present important agricultural rôle until 1800. During the first half of the 19th century Vermont produced seven-eighths of the entire United States crop; and Massachusetts, Vermont and Maine were the chief hop States, but as the quality of the New York hops was far superior, and the quantity three times as great, the former States soon abandoned hop culture. . The result was that during 1850–65 a small portion of New York, lying south of the New York Central Railroad between Rochester and Albany, monopolized the hop raising of the United States. Small patches were planted in Wisconsin and Michigan in 1860 and in 1866, when the New York crop was completely destroyed by vermin, Wisconsin hop-growers obtained exorbitant prices for their excellent product, which induced many to plant hops, expecting to realize a fortune in a few years, but the prices speedily declined owing to an overproduction. During 1870 and 1880 New York again was at the head, but at that time fresh competition began to develop on the Pacific Coast. The «Russian River» hops of California were a marvel; their texture was «fine as silk»; their color «bright golden»; they were «clean picked»; their «content of lupulin» equal to the best German brands, so that hop-culture there advanced quickly to 40,000 bales, the yield of 1902. The hop crop of the United States in 1909 was 40,688,000 pounds, distributed as follows: Oregon, 21,770 acres, 16,583,000 pounds; California, 8,391 acres, 11,995,000 pounds; New York, 12,023 acres, 8,677,000 pounds; Washington, 2,433 acres, 3,433,000 pounds. The acre-yield in the States mentioned was California, 1,400 to 2,200 pounds; Washington, 1,200 to 2,000 pounds; Oregon, 1,000 to 1,600 pounds; New York, 600 to 1,500 pounds. The highest acre-yield recorded was for a locality in Sacramento County, Cal., on a piece of alluvial land four feet deep, where 4,000 pounds to the acre was harvested. The New York hops brought nearly double the price in the market that the Pacific Coast hops commanded, and the imported Bohemian hops brought double the price of the New York hops. New York hops are almost entirely consumed in the United States, while the greater amount of the Pacific Coast hops (especially Oregon) is exported. The English production is scarcely ever sufficient for its needs, so that Great Britain must import some and mostly takes Oregon hops, because they are especially adapted to the English ale brewer's requirements.

Consult Myrick, H., 'The Hop: Its Culture and Cure, Marketing and Manufacture' (New York 1899); United States Agricultural Department's Farmers' Bulletin 304; United States Plant Industry Bureau Bulletin 271 and circular 33.

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HOR, a mountain on which Aaron is said to have died (Num. xx, 22–27, xxxiii, 37–41; Deut. xxxii, 50ff). It is traditionally supposed to have been identical with Jebel Nebr Hārūn, a mountain southwest of Petra.

HORACE (QUINTUS HORATIUS FLACCUS), Roman poet of the Augustan Age: b. Venusia, Italy, 8 Dec. 65 B.C.; d. Rome, 27 Nov. 8 B.C. Our information about Horace's life is derived in the main from his own writings, which are supplemented in a few details by a brief biography attributed to Suetonius. He was born at Venusia, a small town in Apulia, near the boundaries of Lucania and Samnium. His father was a freedman, and, according to Horace's own statement, followed the trade of a *coactor*, or collector. He seems to have prospered, for he was able to purchase a small farm. He was not satisfied to send the boy to the local school of Flavius, which was patronized by the aristocracy of Venusia, but moved to Rome to give his son the best possible educational advantages. It is to his credit that he did this, not that Horace might better his position in life, but for the sake of the education itself. At the capital he supplied his son with the means of making a creditable appearance, and he himself accompanied him to and from his classes, giving him moral instruction in a shrewd and homely way by pointing out men who offered examples to be followed or shunned. To this training Horace owed both his habit of self-examination and his consequent temperance and self-control, and that keen observation of men and things which is one of his marked characteristics. He nowhere makes mention of his mother, who very likely died while he was an infant.

At Rome, Horace pursued the usual grammatical studies under the notorious «flogging Orbilius,» and doubtless supplemented them by more advanced work in rhetoric and literature. It is, however, in marked contrast to the fullness of our information about the other details of his life, that we know little or nothing about the masters who influenced him or about the particulars of his education, except that he implies that he attended the classes of several teachers. We may, however, infer something from the results. He certainly acquired a taste for reading, both in the literature of Greece and that of his native land, a habit which he continued to follow throughout his life. Somewhere about 46 B.C., in his 19th year, Horace went to Athens to study philosophy but he does not seem to have been especially attracted by any particular school. In his early life he leaned toward the Epicurean doctrine, but as time went on he turned more and more to that of the Stoics, without, however, committing himself to either sect. The assassination of Cæsar and the arrival of Brutus in Athens in September 44 B.C. put an end to his quiet student life. He joined the army of the liberators, and received a commission as tribune, though he was in no way fitted for the post. At Philippi he fled from the field with the rest of the routed forces, and, as he himself says, «left his shield behind.» His humble estate was confiscated, but on his return to Rome in 41, when a general amnesty was granted by Octavian, he in some way secured a position as clerk in the quæstor's office, which furnished him the means of livelihood.

Horace freely admits that it was lack of money which first led him to write verse, and it was to his efforts in this line that he owed his advancement. He soon made the acquaintance of Virgil and of Varius, by whom he was introduced to Mæcenas. After a delay of several months, during which the astute statesman doubtless took the young man's measure, his position was established by his admission to the select circle of Mæcenas' literary friends. This honor, as he says with pardonable pride, was due not to high birth, but to his personal character. In 33 he received from his patron a small estate, the famous Sabine farm, situated in the valley of the Digentia, a small stream flowing into the Anio, about 30 miles northeast of Rome. Through Mæcenas he became intimate with the most eminent men of the day, both in literary and in political life, including Augustus. Toward the emperor his attitude was one of dignified independence. He was quick to recognize the advantages of the peaceful and established order of things which Augustus had brought about, and he celebrates it in many of his odes; but he did not hesitate to decline the position of private secretary which the emperor offered him. This he did without giving offense, for Suetonius quotes extracts from letters of Augustus which indicate a cordial and even an intimate friendship. Horace also preserved his independence in his relations with his benefactor, Mæcenas, as appears from several passages in his works, although he showed a proper gratitude for his many favors.

In the year 35 Horace issued his first book of satires, to which he himself gave the title of ‘Sermones,’ or familiar talks. On this branch of literature, which the Romans claimed as their own creation, see SATIRE. He took as his model Lucilius, and at first seems to have followed him closely, but he soon found himself out of sympathy with the earlier poet's severity in invective and disregard of form. In the fourth and tenth satires he subjects the work of his predecessor to a thorough criticism, and defines his own ideal of what satire should be. This book was complete in itself, and begins with an essay addressed to Mæcenas. That the reception given to his first effort, which did not lack serious defects, was not wholly favorable, and that Horace had not satisfied himself, is evident from the poet's own words in the introductory essay of the second book, which seems to have appeared in the year 30. This book marks a great advance on the first, from which it differs in its externals in having no formal dedication and in being cast almost wholly in dialogue form, whereas in the first book Horace himself had been the chief speaker. In the following year, urged by Mæcenas, Horace published his first collection of lyrics, some of which doubtless represent his earliest attempts at verse. It was a volume of 17 Epodes, or ‘Iambi,’ as he himself named them. He chose as his model the Greek iambic poet Archilochus, and followed him closely in form. His work, however, has little of the bitter invective for which the Greek poet was notorious, and Horace shows no little originality both in his choice of themes and in his treatment of them. Six years later Horace, now a man of 42, published the first three books of the Odes, which form a work complete in itself, opening with a dedication to Mæcenas and closing with an epilogue in which he predicts his own immortality. In his choice of metres he followed especially Alcæus and Sappho, from whom he also took many of the subjects of his odes. But he shows the influence of many other Greek poets, as well as considerable independence. Although this work did not wholly escape hostile criticism, it at once placed Horace in the front rank of Roman poets. This position was formally recognized in 17 B.C. through his appointment by Augustus to write the ode, the well-known ‘Carmen Sæculare,’ which was sung at the celebration of the secular games in that year.

His next work was a return to the field of satire, for the ‘Epistles’ belong with the ‘Sermones’ to that branch of literature in the Roman sense of the term. They differ from the ‘Sermones’ in their greater finish and in their external form. Horace regarded the hexameter as the conventional form for satire, and the poetic epistle represents his third and final choice of form for his essays in that measure. The first book was apparently issued in the year 20. Horace was then a mature man, who had made his mark, and his tone is more assured and his self-appreciation is greater, though without any trace of egotism. The practical philosophy of life seemed to him the thing most worthy of serious consideration, and to teaching this he proposed to devote the rest of his literary work. This book, which consists of

20 letters, of which some are genuine and some fictitious, is also dedicated to Mæcenas. The second book is devoted wholly to literary criticism, a subject which lay within the domain of satire and had already been handled in some of the 'Sermones.' The chronology of the book is somewhat difficult. It was probably published in the year 14. Whether the *Ars Poetica* formed the third letter of the second book or not is uncertain. It has been assigned to various years from 20 to 8 B.C., and if it really belongs to the latter date, it must have been published separately, perhaps after Horace's death, and is the latest of his works. The title which Horace gave it seems to have been 'Epistula ad Pisones,' but it received its present designation at an early period. The second book of epistles begins with a letter addressed to Augustus, who is said by Suetonius to have taken Horace to task for dedicating none of his works to him. In his epistles, Horace had formally renounced lyric poetry. Nevertheless, at the express request of the emperor, he published a fourth book of odes in 13 B.C. This collection, though admirable in form and containing some of Horace's best work, is characterized by certain perfunctoriness and lack of spontaneity. It was not addressed to Mæcenas, and is without a formal dedication. This was however, not due to any diminution of his regard for his patron, but to the fact that the book was published by the special request of Augustus.

Of the remaining years of the poet's life we know very little. Suetonius says that he died 27 Nov. 8 B.C., and there seems to be no ground for rejecting this testimony. No authentic portrait of Horace has come down to us. From his own allusions to his personal appearance, and from a letter of Augustus, quoted by Suetonius, we learn that he was stout and short, with dark eyes and hair, but prematurely gray. He further tells us that he was quick to anger, but easily appeased. He never married, and of all the loves of which he sings, Canara alone seems to be other than imaginary.

It is probably safe to say that Horace has been the most widely read of all Roman writers, not excepting Virgil, and that he has appealed to a more varied circle of readers than any of his countrymen. This statement applies especially to his odes, since it is to them that his popularity with the general public is for the most part due. It has been said that the odes are not poetry of the highest type, and that when they are analyzed and their contents subjected to searching criticism, the sum total of poetic material is scanty. This is unquestionably true, yet it is equally true that their influence and popularity have none the less been great. This is due in part to the personality of the man and the sympathetic feeling which he rouses in his readers on account of his broad humanity; and in part to the fact that the very simplicity of the odes and their ease of comprehension appeal to readers of all classes. As Mackail says, he realized that limited as was his own range of emotions, that of mankind at large was still more so. In some cases, notably in the love poems and the convivial odes, we are conscious that he did not always feel even the emotions which he describes. In spite of all criticism, the one undoubted fact remains, that the odes of Horace have pleased readers of all epochs and all sorts and conditions of men.

Horace's claim to originality is greater than is usually admitted. In his day the question of imitation of Greek models had ceased to exist, and the question was, rather, which model to choose. In the Augustan Age we find two schools, those who followed the Alexandrine writers, and those who went back for their inspiration to the Greeks of the classical period. Horace belonged to the latter class. His contempt for the followers of Alexandria is outspoken, and so undiscriminating as to include such really great poets as Calvus and Catullus. He certainly knew how to make what he borrowed his own, and many of his odes are so thoroughly national in character that they can have owed little except their external form to Greek sources. In his satires, in spite of his avowed imitation of Lucilius in the beginning, his originality is far greater, and these are in reality his greatest works. While less popular with the general reader, they are of great interest for the light which they throw on Horace's life, personality and habits, as well as for the vivid pictures which they set before us of the complex Roman life. In his daily walks about the city, Horace used his powers of observation, and drew material from all sides and from all classes of society. Above all we can trace in them his own self-improvement and the development of his character, and the gradual growth of that sound judgment and good taste which characterize the work of his mature years. The satires are further characterized by a genial and good-natured humor. Like Dickens, he chose appropriate names for many of his characters — such as *Novius,* or Newman, for the parvenu, though, like those of Dickens, they were not always of his own coinage. The satires also abound in the familiar phrases of every-day life, in puns and plays upon words, in proverbs and homely fables and stories.

Horace's works, as he himself humorously predicted, became school textbooks at an early period. Juvenal implies that this was the case in his day. This fact and his general popularity led to the numerous commentaries on his works, which began to appear as early as the days of Nero, of which those of Porphyrio, of the early part of the 3d century, and the collection falsely attributed to Helenius Acron, have come down to us. The great number of manuscripts which exists testifies to his popularity in the Middle Ages. His fame at that time was, however, much less than that of Virgil, and, though he also was regarded as a magician, it was only at Palestrina and at Venusia that such legends were current. In modern times his influence on French and English satire has been great, as well as on modern poetry in general. See ODES (Horace).

Bibliography.— The date of the first edition is uncertain, but is earlier than 1471. Since then the editions of Horace's works, or of parts of them, have been legion. Of these may be mentioned as epoch-making that of Richard Bentley (Cambridge 1711), which has often been reprinted (the reprint at Berlin in 1869 contains a word-index by C. Zangermeister). The standard critical text is that of O. Keller and A. Holder (Leipzig 1864–70, a second edition of the first volume containing the 'Odes,' 'Epodes,' and 'Carmen Sæculare,' appearing in 1899). A commentary on this edition is furnished by Keller's ‘Epilegomena zu Horaz’ (Leipzig 1879–80). Of editions with notes may be mentioned J. G. Orelli (4th ed. by W. Hirschfelder and W. Mewes, Berlin 1886–92), containing a complete word-index; A. Kiessling (Berlin, 2d ed., 1890–98); H. Schutz (Berlin 1880–83); these two appear in new editions from time to time; L. Müller, ‘Odes’ (Leipzig 1900); ‘Satires and Epistles’ (Leipzig 1891–93); Wickham, E. C., ‘Odes and Epodes’ (3d ed., Oxford 1896); ‘Satires and Epistles’ (Oxford 1891); Page, Palmer and Wilkins (London and New York 1896). The edition of the ‘Odes and Epodes’ by P. Shorey (New York 1896) is of special interest to the general reader on account of its large number of parallel passages from English poetry.

The simplicity and directness of Horace's thought have been a constant temptation to translators, and the number of English versions, particularly of the ‘Odes,’ is very great. But his care in composition and his inimitable skill in the use of words, his *curiosa felicitas,* as Petronius terms it, make him exceedingly difficult to translate, and, while some brilliant successes have been achieved with single odes, no one has done justice to him as a whole. Many of the attempts which have been made are reviewed in two articles in the *Quarterly Review* (Vol. CIV, 1858, and Vol. CLXXX, 1895). The following may be mentioned: Lord Lytton, ‘Odes and Epodes’ (London 1869); Cooper, ‘Horace's Odes Englished and Imitated by Various Hands’ (London 1880); Martin, ‘Works of Horace’ (Edinburgh 1888); Conington, ‘Odes and Epodes’ (3d ed., London 1885); ‘Satires and Epistles’ (London 1892); Gladstone, ‘Odes’ (New York 1894); Green, ‘Odes and Epodes’ (London 1904). An edition of Horace's works, in six volumes, containing both text and translations, has recently been issued by the Bibliophile Society of Boston. To give an adequate literary criticism of Horace is nearly as difficult as to translate him, and is out of the question within the limits of a brief article. Consult the various histories of Roman literature, especially that of Mackail (New York 1900); Sellar, ‘Roman Poets of the Augustan Age — Horace and the Elegiac Poets’ (London 1892); Nettleship, ‘Lectures and Essays’ (Oxford 1885); Patin, ‘Etudes sur la poesie latine’ (3d ed., Paris 1883); Tyrrell, ‘Latin Poetry’ (Boston 1895); Boissier, ‘The Country of Horace and Virgil’ (London 1896); Lang, ‘Letters to Dead Authors’ (London 1886).

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HORACE'S SATIRES AND EPISTLES. The ‘Satires and Epistles’ of Horace, each in two books, appeared at irregular intervals from 35 B.C., when the poet was 30 years of age, to almost the close of his life in 8 B.C. They are the products of a mature and well-balanced mind and spirit, and are most fully appreciated by readers of philosophic age. In spite of the dual title, the variety of their subject matter and the length of experience they represent, they form a homogeneous body of literature. Horace himself calls them all *sermones,* which may be translated «discourses,» «talks,» «chats» or *causeries;* thus testifying to their likeness in his mind. There is less personal satire and more formal philosophy and literary criticism in the Epistles than in the Satires; but they are essentially one. The Epistles are only Satires rendered by advancing age and experience more mellow in spirit and more urbane in manner. The same form is employed throughout the four books; they are all in hexameter, the author disclaiming any pretension to verse in the lofty style and professing a natural freedom and simplicity, yet holding to the ideal of urbanity and purity. The content also is homogeneous; the prevailing theme is human life. The Satires and Epistles are most of all a revelation of human nature. First, there is the self-revelation of the author himself. These compositions tell us not only most of what we know of Horace's origin and of his rise from the humblest of positions to a place in the friendship and esteem of the best and greatest men of the age; they have the more important effect of making us intimately acquainted with one of the most sympathetic personalities in the literature of all time. The Horace of the Odes is on the whole the court poet, the exquisite product of the higher culture of Rome and Athens; in the Satires and the Epistles it is the simple, direct and natural Horace of ordinary Italian manners and ideals, who appears only occasionally in the Odes and whom we may call the real Horace, that is everywhere face to face with the reader. No poet establishes so easily and so completely the personal relation with us. There are few expressions of self in all literature so spontaneous, so sincere and unreserved, so complete and so engaging. Horace becomes the reader's familiar and friend — «the friend of my friends and of so many generations of men,» as Andrew Lang addresses him. In the second place, the Satires and Epistles are a revelation of the poet's *milieu.* In every composition he is addressing some one of his great number of friends, and in this way holds the mirror up to a wide diversity of character and circumstance in one of the greatest ages in history. The Satires and Epistles are kaleidoscopic with scenes not only from the larger life of the time, but also from the daily life of men in the humbler walks of existence. Their pages are golden with the poet's own reasoned contemplation of the facts of life in beautiful and fruitful Italy, and with the homely thought, precept and action of the common man as well. The story of the town mouse and the country mouse find its best telling in Horace.

Again, the Satires and Epistles reveal the reader to himself. This is their greatest charm and their greatest value. They are timeless; they are universal. Their vignettes from nature, their miniatures of the life of men, their tributes to friendship, their homely anecdotes, precepts and aphorisms, their sound common sense, their quiet humor, and, above all, their genial philosophy of life, belong to the common stock of human experience. Even those epistles which are devoted for the most part to literary criticism, far-reaching as their influence upon letters has been, owe their effect hardly more to their exposition of critical principles than to a certain fund of good sense that applies to life in general. In a word, Horace in the Satires and Epistles is an engaging personality with the gift of art — the man of wide and deep experience in a stirring age who not only looks upon life with understanding and sympathy, but is able to give attractive and effective expression to his thoughts. For keen but genial and charitable contemplation of the human comedy, for kindly humorous and winning expression of the philosophy of life, Horace has no equal. His works, especially the Satires and Epistles, are one of the rare crystallizations of life into art.

The best Satires are I — 1, 4, 5, 6, 9; II — 1, 6, 8. These and all of the Epistles should be read in connection with the more personal and philosophic Odes, such as I — 9, 11, 31, 35; II — 2, 3, 6, 10, etc. The verse translations of Theodore Martin and Conington are well known.

Grant Showerman.

HORÆ, hō'rē, in Greek mythology, goddesses of the seasons. They were generally regarded as attendants of the gods and guardians of the Olympian gates. Their characteristics, however, varied and their number was variously represented as two, three or four. Hesiod names three — Eunomia (good order), Dike (justice) and Eirene (peace), and thus makes prominent their attributes as also guardians of social and political conditions.

HORATII, hō-rā'shĭ-ī, three Roman brothers who, in the reign of Tullus Hostilius, engaged the same number of Alban brothers (the Curiatii), in order to decide the contest between the two nations. A sister of the Horatii was betrothed to one of the Curiatii; but both sides forgot their private relations in the service of their country. Two of the Romans soon fell. The contest was unequal, but Horatius saw his antagonist faint with the loss of blood. In order therefore to separate them from one another, he feigned flight, and, while they pursued him as well as their wounds would permit, at unequal distances, he suddenly turned and slew one after the other. He was conducted back to the city amidst the rejoicings of the Romans, adorned with the spoils of the slain. There he saw in the crowd his sister in tears for the death of her betrothed. Angered that her lamentations for her lover should mingle with the rejoicings of the nation on his victory, the brother plunged his dagger into her breast. He was condemned by the duumviri to be scourged to death, but he was later pardoned.

HORATIUS, commonly called Cocles (the one-eyed), a Roman hero, who, with the aid of Lartius and Herminius, kept the Tarquins under Lars Porsena from crossing the Sublician Bridge. These three kept the vast array of enemies at bay while the Romans cut the bridge down. When it was about to fall, Cocles sent his companions back, but he himself, when it had fallen, plunged into the Tiber and swam to the Roman shore. He received a reward of as much land «as two strong oxen might plow from morn till night» and a statue was erected in the Comitium. Consult Macaulay, ‘Lays of Ancient Rome.’

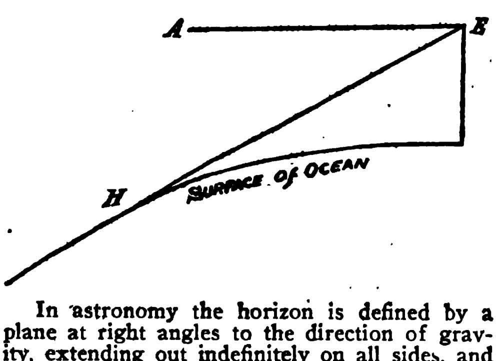
HOREB, hō'rĕb, a mountain in the northern part of Arabia, of the same ridge as Mount Sinai, which lies not far distant from it, memorable in the history of Moses. The monks on Mount Sinai still point out the rock on Horeb from which water issued at the blow of Moses.

HOREHOUND, or **HOARHOUND,** so named from the white downy or hoary appearance of the stem and branches, the name given to plants of the mint family of which *marrubium vulgare,* the common or white horehound is the most widely distributed species. It occurs in the northern temperate latitudes of America, Europe, Asia and Africa, and is popularly used for its medicinal properties as a cure for coughs, in the form of an infusion, as a syrup with sugar or as rock candy. It has a pungent aromatic odor, a bitter taste and is stimulant, tonic and laxative. It grows in waste places, on dry chalky or sandy ground and is a perennial with a sturdy root stock, thick stems, one to one and one-half feet high, ovate wrinkled leaves and clustered whorls of white flowers. *Ballota nigra* black or fetid horehound, of the same natural order *Labiatæ,* resembles white horehound in its medicinal qualities. Water horehound or gypsy wort, *Lycopus,* is a plant of the same order of which several species have been successfully introduced with the white and black horehounds in the United States.

HORGAN, Stephen Henry, American editor: b. Norfolk, Va., 2 Feb. 1854. He was educated at Cork, Ireland, the public schools of Nyack, N. Y., and the College of Saint Francis Xavier, New York. In 1874 he was photographer on the *New York Daily Graphic* and from that year to 1907 gave all his time to newspaper illustration; was art manager on several New York dailies, managing editor of the Newark *Monitor,* etc. He invented a process of illustrating the *Daily Graphic* of New York. He was the first to make half-tone illustrations which could be successfully reproduced on news print paper. He published ‘Three Color Process Work’ (1902); ‘Horgan's Half-tone and Photo-Mechanical Processes’ (1912); ‘About Photo-Engraving’ (1914).

HORICON, hŏr'ĭ-kŏn. See Lake George.

HORIZON. In its most familiar sense the horizon is the line or circle around which earth and sky seem to meet. On the ocean this circle is smooth and easily visible, and is then called the *sea horizon.*



In astronomy the horizon is defined by a plane at right angles to the direction of gravity, extending out indefinitely on all sides, and called the *plane of the horizon.* The circle in which this plane cuts the celestial sphere is called the *astronomical horizon.* All points of it are apparently on a level with the eye of the observer. Owing to the rotundity of the earth the sea horizon is lower than this astronomical horizon — a narrow strip of sky separating the two. The angular distance between them, A E H, is called the *dip of the horizon*. The higher the observer is above the ocean, the greater is the dip. To an eye on the surface of the water, the sea horizon and the astronomical horizon coincide, so that there is no dip. The geometrical principle which determines both the dip and the distance of the visible horizon are seen in the figure. The circular arc is here the surface of the ocean. The eye of the observer is situated at the point E, a short distance above the surface of the water. A tangent drawn from the eye to the surface meets the latter at the visible horizon, H. Let a horizontal line E A be drawn from the eye, the angle A E H is then the geometric dip of the horizon. The geometer will readily see that this is equal to the angle subtended at the centre of the earth between the observer, at E, and the point H. Since one minute of arc in the curvature of the earth's surface corresponds to one nautical mile, it follows that, geometrically, the dip of the horizon in minutes is equal to its distance in nautical miles. But, in the actual case, the line of sight is curved in consequence of the refraction of the air. The result of this is that the actual horizon is further than given by the geometric theory, and the dip somewhat smaller. The following table shows the relation between the apparent dip and the height of the eye above the water and the distance of the sea horizon.

Height in Feet	Dip of Horizon	Distance of Horizon Miles
1	1.0	1.3
2	1.4	1.8
3	1.7	2.3
4	2.0	2.6
9	2.9	4.0
16	3.9	5.3
25	4.9	6.6

On board a steamship the eye of an observer on the promenade deck is generally from 15 to 20 feet above the water. It follows that the distance of the horizon is about five miles. A ship farther away than this will have more or less of her hull below the horizon. At double the distance the entire hull will be below the horizon, and only smokepipe and masts visible. As she goes yet further, these also will disappear, as if sinking below the water.

On land the plane of the true horizon is frequently determined by a so-called artificial horizon. This may be either a small rectangular basin containing metallic mercury or else an accurately surfaced plate which is mounted upon three leveling screws and adjusted to the horizontal plane by means of a small level which may be placed in various positions upon it. The first form of artificial horizon is shown in the figure. In use the basin is placed upon an approximately level portion of the ground or other firm support, the mercury is poured into it, and the glass roof is placed over the whole. If a sheet of paper is first laid upon the ground below the basin, this will prevent moisture from accumulating on the inside of the glass plates and so blurring the reflected image. It is evident that if the observer measures the angle between any object in the sky and its image as seen reflected in either form of artificial horizon, the result thus obtained will be twice the altitude. When altitudes are measured at sea, the ray of light from the distant sea horizon passes immediately above the surface of the ocean through many miles of dense and wet air before it enters the telescope. Its change in direction by refraction is therefore very great and very uncertain in amount, so that however carefully the observations may be made, the resulting positions will be uncertain by at least from three to five miles and often by much more. With the artificial horizon, however, both the rays of light which fall on the mercury and those which enter the telescope directly pass through our atmosphere at an altitude equal to that of the body observed; the effects of refraction can here usually be determined with a high accuracy. Thus on voyages of exploration, when the ship approaches sufficiently near any island or coast, a sextant party is usually set on shore by boat to determine the position by a land observation. The position of the horizon plane as a fixed plane of reference for large, solidly mounted instruments of astronomy is usually determined by means of the spirit level. See ASTRONOMY, PRACTICAL.

Artificial Horizon.

SIMON NEWCOMB.

HORN, a tough, flexible, semi-transparent substance derived from the epidermis, which may be developed morbidly as a corn, or naturally, as in the callosities on the legs of a horse; or in connection with important functions, as when it forms the outer sheath of the outgrowths upon the heads of ungulate animals, called «horns,» the «shell» of the tortoise, the nails, claws and hoofs of animals, the beak of bird and turtle; and the hairs and feathers of mammals and birds, or their modification into spurs, scales, pines, bristles, whalebone, nasal horns, etc. This epidermal tissue consists largely of keratin, an albuminoid composed mainly of carbon (about one-half), oxygen, nitrogen and sulphur.

The horns of mammals are in effect modifications of the hairy integument covering parts liable to great wear, or needing to be hard and sharp, especially the outgrowths of the skull characteristic of male ruminants. Hollow horns are usually unbranched and persistent, but in the prong horn they are shed annually while the bony cores grow and their vascular coverings persist and give rise to the new horns.

Hollow horns are found usually in both sexes, but in some genera of antelopes only in the male. In the pronghorn the horns of the female are almost hidden in the hair of the head, and are small, short and unbranched. Such horns as these are called hollow or sheath horns, and are very different from antlers (q.v.). Another form of true horn is that on the snout of the rhinoceros (q.v.) where, when more than one appears, the projections stand one behind the other in a median line, and not side by side. This nasal rhinoceros-horn is not a hollow sheath clothing a bony core, but a solid mass of coarse agglutinated hairs arising from the skin and supported by a thickening of the underlying bone.

Utility of Horn.— In their natural form, the horn-sheaths of oxen, sheep and antelopes have been put to a great variety of use, as weapons, receptacles, handles and musical instruments — the latter surviving in certain ceremonial usages and in the general term "horn" for a wind instrument. Cleaned and polished it served many additional needs, forming the primitive drinking cups; and it is from this ancient usage that the general name of "horns" has been given to a species of drinking cup, and its spirituous contents. The horns of victims sacrificed to the gods were often gilded by the Romans and suspended in the temples, more especially in those of Apollo and Diana. From the most remote times the altars of the heathen divinities were likewise embellished with horns, and such as fled thither to seek an asylum embraced them. Originally the horns were doubtless symbolical of power and dignity, since they are the principal feature of gracefulness in some animals, and instrument of strength in others. Hence these ornaments were frequently bestowed in imagination and art upon gods, and were actually worn by heroes. In more modern times ox-horns have been used the world over for carrying gunpowder; and museums abound in quaint relics of this kind elaborately ornamented by soldiers and hunters. Small bottles (inkhorns) of this substance were the first receptacles for ink, and are still used in the East, where opium for smoking is usually kept in horn-boxes. Before the general adoption of glass panes in windows thin plates of horn were often used, as they still are in barbarous parts of Asia; lanterns were made of them; and the faces of the mediæval hornbooks were so protected. The material now lends itself to manufacturing into many other articles by reason of its toughness, pliability and capability of being softened by heat and then molded. The heat is applied in the form of hot water; and splitting into thin sheets, or welding pieces together, or molding fragments into various forms, may all be accomplished under combined moisture, heat and pressure. Both the natural horn and the molded substance may be carved, or impressed with a die, polished and dyed. Hence an enormous variety of useful and ornamental articles may be made, and the horns of cattle have commercial value.

HORN, a musical instrument, originally formed, as the name denotes, from the horn of an animal. The name includes a large family of wind-instruments, many of which have fallen into disuse. The hunting-horn was long the chief form extant. The French horn consists of a metallic tube of about 10 feet in length, very narrow at top, bent into rings, and gradually widening toward the end whence the sound issues, called the bell, or in French the *pavillon.* It is blown through a cup-shaped mouth-piece of brass or silver, and the sounds are regulated by the player's lips, the pressure of his breath and by the insertion of the hand in the bell of the instrument. The compass of the instrument is three octaves. Music for the horn is always written in the key of C, an octave higher than it is played, with the key of the composition marked at the beginning of each movement. Great improvements have been made in the instrument by C. J. Sax of Paris, whose saxhorn gives a greater volume of sound than the old instrument. The buglehorn is a tube of 3 feet 10 inches in length bent into small compass. It is usually provided with keys, and has a range of two octaves, and notes commencing with the upper B of the bass clef.

HORN, Cape. See CAPE HORN.

HORN-FLY, a European fly (*Hæmatobia serata*), since about 1890 became widespread in North America, which have a curious habit of clustering in masses about the base of the horns of cattle. It is closely related to the house-fly and stable-fly, and although annoying does no serious harm to the cattle or their horns.

HORN REEFS, off the coast of Jutland, Denmark, where a light ship is stationed. It was in this vicinity that the naval battle of Jutland was fought between the British and German fleets, 31 May to 1 June 1916. That fight is sometimes called the battle of Horn Reef. See WAR, EUROPEAN: BATTLE OF JUTLAND.

HORNADAY, William Temple, American naturalist: b. Plainfield, Ind., 1 Dec. 1854. He studied zoology and in 1875–79 visited as a zoological collector South American countries, India, Ceylon, the Malay Peninsula and Islands. In 1882–90 he was chief taxidermist of the United States National Museum, and in 1896 was appointed director of the New York Zoological Park. In 1907–10 he was president of the American Bison Society. He has been active in promoting game preserves and new laws for the protection of wild life generally. He advocated the Bayne law to prohibit the sale of native game; and the new tariff law to prohibit all importations of wild birds' plumage into the United States for millinery purposes. His publications are 'Two Years in the Jungle' (1885); 'Free Rum on the Congo' (1887); 'The Extermination of the American Bison' (1887); 'Taxidermy and Zoological Collecting' (1892); 'The Man who Became a Savage' (1895); 'Guide to the New York Zoological Park' (1899); 'The American Natural History' (1904); Camp-Fires in the Canadian Rockies' (1906); 'Camp-Fires on Desert and Lava' (1908); 'Our Vanishing Wild Life' (1913); 'Wild Life Conservation in Theory and Practice' (1914).

HORNBEAM (*Carpinus*), a genus of trees of the family *Betulaceæ,* of which the species *C. betulus* is common in Europe, in some places growing to nearly 100 feet in height, although in Great Britain, where it is much planted, it is a small tree. It is also called horn-beech, hardbeam and yoke-elm. It has staminate flowers in cylindrical catkins; fertile flowers in lax catkins; nuts in pairs. It grows in woods and hedges, often in a damp tenacious soil, and forms a principal part of the ancient forests on the north and east sides of London. The wood is white, tough and hard, and burns like a candle. It is used in turnery for cogs of wheels, etc. The inner bark yields a yellow dye. The American hornbeam (*Carpinus caroliniana*) is a small tree rarely attaining the height of 30 feet, sparingly diffused over the eastern United States. It is also called water-beech, blue beech and ironwood. The wood, fine-grained, tenacious and very compact, is used for handles, as of carpenter's tools, etc., its serviceability being restricted by reason of its inferior size. See IRONWOOD.

HORNBILL, a genus (*Buceros*) and of a family (*Bucerotidæ*) of birds now placed in the division (*Coraciiformes*), and related to the hoopoes and owls. The species are numerous and are found in Africa, India and throughout the Malayan region as far as New Guinea, are mostly large birds, the largest being more than four feet long, the smallest rather smaller than a magpie. They are bulky birds of heavy, noisy flight; their large bills are surmounted by bony crests or «helmets» of varied shape and sometimes of great size, but rendered light by the presence of numerous air-cells. Their food is principally fruits, but in certain circumstances they become to a great extent omnivorous. Thus a well-known South African ground-hornbill devours snakes, and is highly regarded by the negroes because of its enmity to them, and ability to overcome the largest and deadliest vipers. Several are mainly terrestrial in their habits. The most curious fact regarding these birds is that during the breeding season the female is imprisoned on her nest in a cavity in a tree-trunk, she herself apparently gradually plastering up the entrance by the use of her excrements, until there is left only a small aperture through which the male supplies her and her offspring with food until the young ones are nearly full grown. In captivity the male bird has been observed to disgorge at intervals the lining of his gizzard in the form of a bag, and it is supposed that the food supplied to the female during her term of captivity in the breeding season is enclosed in this structure.

HORNBLENDE, hôrn'blĕnd, or **AMPHIBOLE,** an abundant and widely diffused mineral, remarkable on account of the various forms and chemical compositions that it exhibits, and its diversified colors. Almost numberless varieties of it are recognized, to many of which distinct names have been given. It crystallizes in the monoclinic system, and is brittle, with a hardness of from 5 to 6 and a specific gravity of from 2.9 to 3.4, according to its composition. It has a vitreous or pearly lustre, and its fibrous varieties often have a silky appearance. The variety most commonly known as «hornblende» is usually black or greenish black, and occurs in many rock formations, notably in granites and basalts, and in certain schists and slates. The strongly colored varieties are pleochroic. Common hornblende is a silicate of iron, aluminum, magnesium and calcium. The various hornblende minerals are now collectively known as the «amphibole group.» See AMPHIBOLE.

HORNBOOK, an elementary school book in use in England down to the time of George II. It was made up of a single leaf on which was written the alphabet in large and small letters; the Roman numerals, and the Lord's Prayer. The leaf was sometimes set in a frame and sometimes pasted against a piece of sliced transparent horn; hence the name. There was a handle through which a string was inserted whereby the book might be tied around the waist.

HORNE, Richard Henry, or **Hengist,** English poet and essayist: b. London, 1 Jan. 1803; d. Margate, 13 March 1884. He was educated at Sandhurst and entered the Mexican navy as midshipman, serving till the close of the Mexican war of independence. He then returned to London to begin a literary career. To his early period belong two tragedies, ‹Cosmo de' Medici› (1837), and ‹The Death of Marlowe› (1837), both of which contain fine passages. A poem sent to him for criticism by Elizabeth Barrett opened the way to a cordial friendship and a correspondence that extended for seven years. In 1852 Horne removed to Australia, and remained there until 1866; his book, ‹Australian Facts and Prospects,› being one outcome of this residence. Again returning to England, he continued literary work until his death. His last publications were tragedies, including ‹Judas Iscariot: A Miracle-Play› (1848), and a curious prose tract, ‹Sithron the Star-Stricken› (1883), which he pretended to have taken from the Arabian. His best-known work, however, is his epic poem ‹Orion› which Poe said might be called «a homily against supineness and apathy in the cause of human progress, and in favor of energetic action for the good of the race.»

HORNED DACE, RATTLESNAKE, SCREAMER, VIPER, etc. See DACE; RATTLESNAKE.

HORNED TOAD, lizards of the family *Iguanidæ*, popularly called toads from a certain general resemblance in form and manner to those animals. The body and head are broad, thick and flattened, the tail short and the usual attitude a sort of squatting posture with the head elevated. About a dozen species of the genus *Phrynosoma* occur in the arid parts of the southwestern United States and in Mexico. The best known are *P. cornutum* and *P. coronatum*, which, becaus of the bizarre appearance, quaint ways and tolerance of captivity, are often brought back as souvenirs by visitors to those regions. The scales on the body bear prominent conical spines, and the long horns of the head are supported by bony cores. Their mottled brown and gray colors harmonize well with their natural surroundings. The horned toads love to bask in the sunshine in the hottest weather and to bury themselves in the burning sand. Never very active, they become extremely sluggish in cool or dull weather and hibernate in the winter. They feed on all kinds of insects, for which they search only during the hottest hours of the day, and drink copiously of water when sprinkled in the form of drops. Like many other lizards, but unlike most of the *Iguanidæ,* they are viviparous.

HORNED VIPER. See Viper.

HORNELL, hôr'nĕl, N. Y., city in Steuben County, on the Canisteo River, and on the Erie and the Pittsburgh, Shawmut and Northern railroads, about 57 miles south of Rochester and 46 miles northwest of Elmira. The first settlement was made in 1790, but it was a part of Canisteo and was called Upper Canisteo until 1820. The present name was given in honor of George Hornell, who had done much for the early development of the town. It was incorporated as a city in 1890. Hornell is situated in a fertile agricultural region, noted for fruit. Its chief manufactures are sash, doors and blinds, railroad supplies, furniture, leather, carriages and wagons, silk, bricks, beer, electrical machinery, tiles, wire-fencings, gloves and agricultural implements. It has a good public high school, Saint Ann's Academy, Saint James Mercy Hospital and a number of fine public and private buildings. The government is vested in a mayor, who holds office two years, and a city council. The subordinate officers are appointed by the mayor subject to confirmation by the council. The waterworks are the property of the city. Pop. 14,341.

HORNER, William George, English algebraist: b. 1786; d. Bath, 22 Sept. 1837. He was educated at a private school near Bristol, and later taught there, becoming head master in 1806. In 1809 he established a school at Bath, which he conducted until the time of his death. His only work of importance was his discovery of a method of solving numerical equations of any degree, which he first announced in a paper read before the Royal Society in 1819, and afterward published in the ‹Philosophical Transactions.› The method is still in use, and is known by Horner's name. See Algebra, History of the Elements of.

HORNET. The true hornet is a European wasp (*Vespa crabro*); but in America the term is applied to almost any form of large stinging wasp, especially such as make papery nests. In some portions of the United States this is considered the only «hornet,» but in the vicinity of New York the European hornet also occurs; and southward a somewhat smaller species (*V. carolina*) goes by this name.

HORNET, The, the name of two sloops-of war in the American navy during the War of 1812. The chief was a ship-rigged 18-gun sloop, and did brilliant service. Through December and January 1812–13, under Master-Commandant James Lawrence, she blockaded the 20-gun English sloop *Bonne Citoyenne* in the harbor of Bahia, Brazil, till overmatched by a 74; Lawrence was surprised and was obliged to take refuge in the harbor, but instead of being blockaded, slipped out the next night under the very guns of the man-of-war. After capturing a merchantman, on 24 February, he fell in with the English sloop-of-war *Peacock,* Capt. William Peake, each at this time having 20 guns; they engaged at 5.25 P.M., and in 11 minutes the *Peacock* was a sinking wreck and surrendered. Her captors made every effort to keep her afloat, but in a few minutes she sank, carrying down 13 of her own crew and three of the *Hornet's.* Peake and four men were killed and three wounded; the *Hornet* had one killed and two wounded, besides two more hurt by an exploding cartridge. «A vessel moored for the purposes of experiment could not have been sunk sooner,» said an English paper of the time; «it will not do for our vessels to fight theirs single-handed.» On 22 Jan. 1815, under Capt. James Biddle, she encountered off Tristan d'Acumha, in the south Atlantic, the English brig *Penguin,* Capt. James Dickinson, with 19 guns of about the same metal as her own 20; in 22 minutes the *Penguin* surrendered, but on Biddle going forward, two British seamen shot him in the neck (not vitally), and were immediately shot down themselves. The *Penguin* lost her captain and 9 others killed and 38 wounded; the *Hornet,* 1 killed and 11 wounded. The *Penguin* was shot to pieces, and could not be taken away, so she was scuttled; the *Hornet* was almost uninjured. On 28–29 April she had a long chase from the British ship of the line *Cornwallis,* the rear-admiral's flagship, and only escaped by thoroughly dismantling herself.

HOROLOGY. See Clock; Clock-work.

HOROSCOPE. See Astrology.

HORROCKS, hŏr'ŏks, **Jeremiah,** English astronomer: b. Toxteth, near Liverpool, about 1617; d. 3 Jan. 1641. He was educated at Cambridge and was appointed in 1639 to the curacy of Hoole, Lancashire, and in that village made his famous observation (24 Nov. 1639, O. S.) of the transit of Venus, the first on record. Newton, in the ‹Principia,› bears honorable testimony to the value of Horrock's astronomical work. The observation of the transit is by no means regarded as his sole astronomical achievement, as he added to our knowledge of the physical cause of celestial motions, deducted the solar parallax, corrected the solar diameter and made tidal observations. Hevelius printed the ‹Venus in Sole Visa,› which was first published in Germany (1662); a translation of this work, with memoir by Whatton, appeared in 1859.

HORSCHELT, Theodor, German painter: b. Munich, 1829; d. 1871. He began his early studies in the Munich Academy, and later became a pupil of Albrecht Adam. At first he painted horses, among which is ‹The Poacher› (1850), and then turned to military scenes, painting ‹The Seizure of Shamyl› and ‹Cossacks Returning from a Razzia.›

HORSE, in a general sense, a member of the ungulate family *Equidæ;* but in ordinary use the word designates the single domestic species (*Equus caballus*), the wild original of which is unknown. It is not decided, in fact, whether a single species, or more than one, was the source, nor where the domestication of the horse was first effected. The evolution of the species is elsewhere sketched. It is probable that at the dawn of civilization the wild ancestors of our modern horses roamed in bands over the whole extent of grassy uplands stretching from northern Africa to eastern Manchuria, on the steppes of Russia, and wherever in Europe open country might be found; and it is also probable that they were among the first animals which men killed for food and afterward captured and tamed in order to keep a supply of food under control. This act must have been one of the earliest steps toward community life and civilization. The oldest paintings and carvings left by the ancient inhabitants of the valley of the Euphrates show that saddle-horses were familiar to them; and it is fair to suppose that the supremacy primitively gained by the people of central Asia over other parts of the world was largely due to their use of horses in war, giving them a great advantage over unmounted tribes; but it was not until much later — probably no earlier than 2000 B.C. — that the animal came into use in Arabia and Egypt, where before had been only camels and asses. So far as can be judged, these early Assyrian war-horses were rather small, robust, large-headed and shaggy beasts, much like Przewalsky's horse or the kiang. A very similar animal was domesticated by the men of the Polished Stone Age in Europe, excellent portraits of which were etched by neolithic artists upon pieces of bone, and have come down to us among the contents of graves opened by archæologists in France, Switzerland and elsewhere. Later, but still in the prehistoric period, Europe was repeatedly invaded by Asiatic hosts who brought with them Eastern horses. These modified, if they did not supersede, the local stock. When Rome conquered the barbarous inhabitants of Europe its horses, which were of Asiatic stock, with perhaps some African mixture, largely superseded those of the conquered tribes, and from the mingling there sprang the big heavy breeds which characterized the Middle Ages, and were intended for strength and weight-carrying, rather than for nimbleness and speed. It was not until near the end of the 17th century that the introduction into France and England of certain sires of Arabian breed — a clean-limbed, small-headed, agile, hardy race, which arose in Arabia and Palestine about 2,000 years ago — began the improvement of British stock, which has reached its highest development in the modern European racehorse, coach and hackney. The normal horse lives to about 18 or 20 years; he is not valued for stud after 20. Occasionally some live to 40 or 50 years. The long intestinal tract seems to operate against longevity. The term horse is applied to males of the *Equus*, as well as to the entire family. A stallion is a mature uncastrated male, also termed a stud-horse; a gelding is a castrated or unsexed male, it being customary to castrate all except those used for breeding. A mare is a female of the horse family. Right after birth the young animal is termed a foal, a little later a colt. The young mare is distinguished as a filly.

The horse owes his speed largely to his long, clean limbs, the advantageous angles made by the leg bones, and to the substitution of a single strong bone for the ulna and radius in other quadrupeds, together with the growth of a strong hoof out of a central toe. The joint corresponding to the knee in man is close to the body, while the horse's wrist-joint is 18 or 20 inches from the ground in a fair-sized animal's foreleg. The horse's hip or thigh joint is entirely imbedded within his muscular hip, and the knee-joint is close up to the body, while the ankle-joint of the hind leg is at the height of a man's knee. By walking and running on his toes, the horse has gained one more joint for leg action. The teeth of the horse are also peculiar. On each jaw of a mature horse are 6 incisors, 2 canines, 6 premolars and 6 molars; but most mares are minus the incisors. See HORSE, EVOLUTION OF THE, for further peculiarities of teeth and bones.

The best American horses are derived from the English thoroughbreds, though the heavy draft horses mostly show Flemish origin. The light mustang or Indian pony is descended from the early Spanish stock that came to Mexico in 1519 and later; but the great majority of horses in this country come under the title farm horses, and these are fully tabulated by the United States census, together with their half-brothers, the mules.

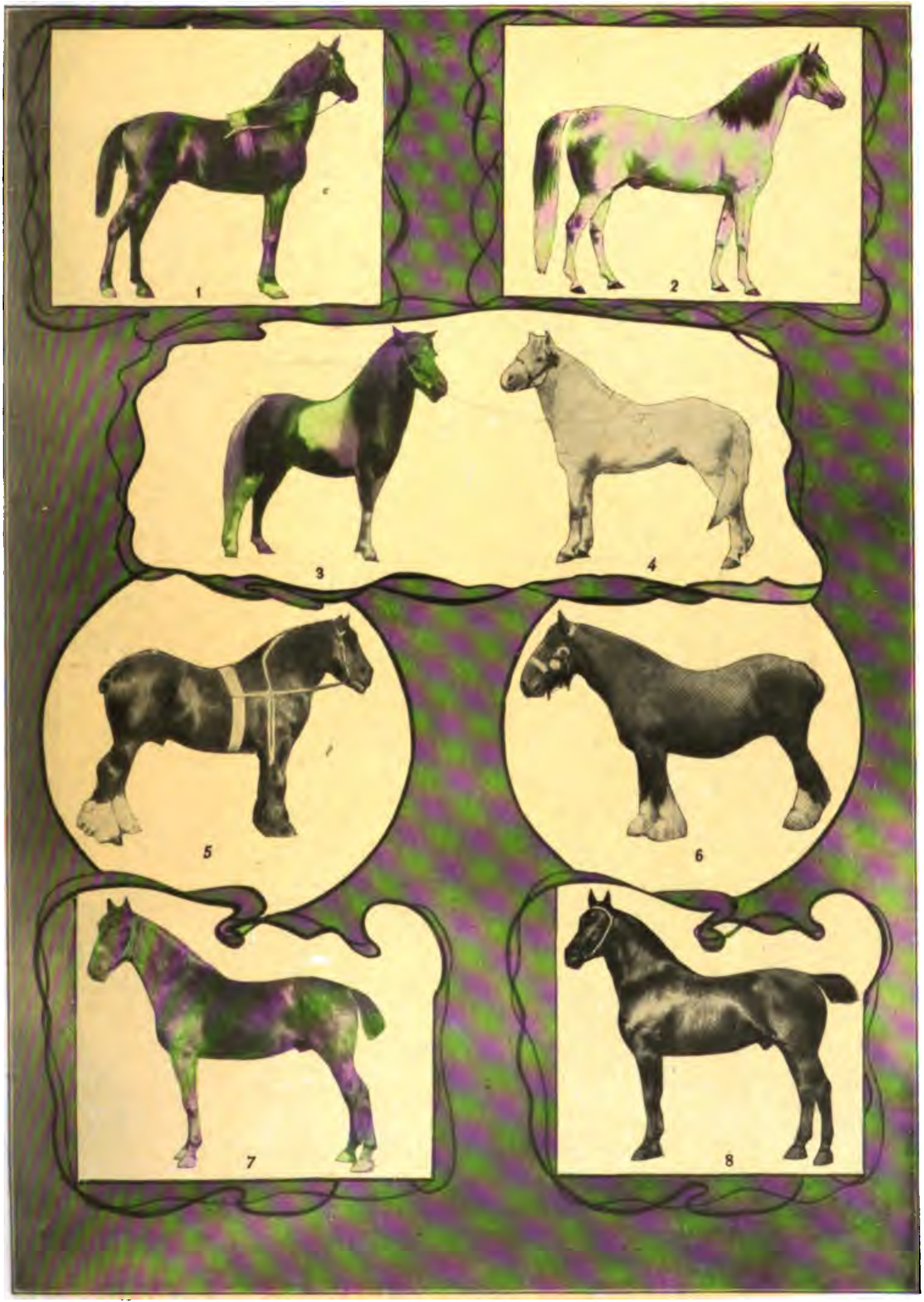
Farm Horses.— In 1850 the census recorded 4,336,000 horses on the farms of the United States; in 1880, 11,201,000; in 1900, 13,537,000; and in 1910, 19,833,000, of the value of $2,083,000,000, or a little more than $100 per animal. This figure included the colts, the average value of grown or mature horses being $112.36. The 1910 census showed 4,209,000 mules on the farms, of the value of $525,000,000, or $131.49 each for mature mules. Thus it appears that the humble mule is more valued on the farm than the better bred horse. And this in spite of the fact that a very large proportion of these farm horses have good blood in them from the common use of stallions rated in the stud books, or their near relatives. It is not believed that there has been a rapid increase in American farm horses since 1910. The estimates of 1917 run between 21,000,000 and 22,000,000. In addition to these farm animals there are at least 250,000 blooded horses registered in the stud books of the 19 United States horse-breeding associations, and probably a million city and town horses not enumerated in the census.

Texas is the leading State for breeding farm horses, having 1,870,000 in 1910. But territory and population considered, Illinois is the banner State, having over 1,600,000 in the census year. Other States having over 1,000,000 are Iowa, Missouri, Kansas, Nebraska and Oklahoma. In the South Atlantic States almost half the farms report no horses at all, but this is not due to scarcity of horses, rather to the fact that small tenant farmers are numerous, who use the horses of their landlords.

Horses are commonly denominated as thoroughbreds, coach, hackney, Cleveland bay, several varieties of draft, trotter, pacer, hunter, roadster, saddle, bus, express, farm, pony, mustang, broncho, cayuse, etc. The thoroughbred, from which most of the blooded horses are descended, is fully described farther on, as the progenitor of the American trotter. The hackney or nag is the common English everyday livery horse, what some would call a light coach horse, of no particular breed. The French coach horse is slightly taller and heavier than the hackney type, and there is a registry of blooded horses of this name. The German coach may be a Hanoverian, Oldenburg, East Prussian, etc. He is typically 15 to 16¾ hands, stylish and sleek, and may weigh up to 1,500. The Cleveland bay is a coach, obtained by crossing English thoroughbreds with Cleveland mares. They are 16 to 16.2 hands and weigh 1,200 to 1,500. This type makes an excellent farm horse as well as coach and the United States registry increases.

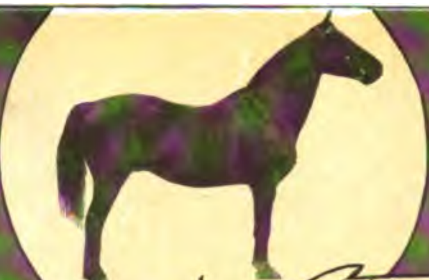
Draft-horses are mainly of Flemish origin,

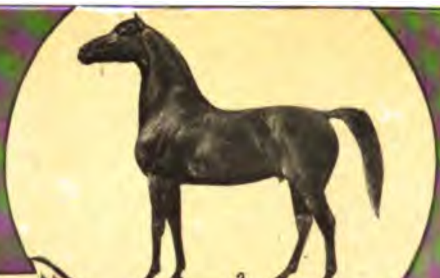
HORSES

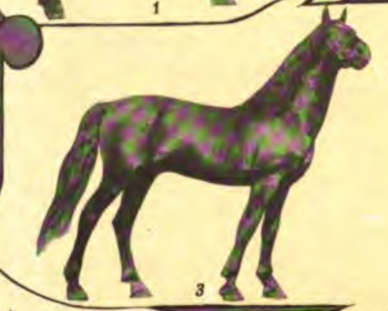


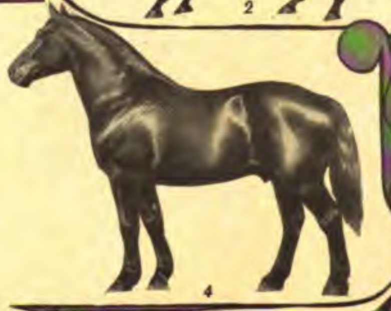
1 Pure Arabian
2 Arabian Stallion
3 Shetland Pony
4 Welsh Mountain Pony
5 English Shire Stallion
6 Clydedale Gelding
7 French Coach Horse
8 English Hackney

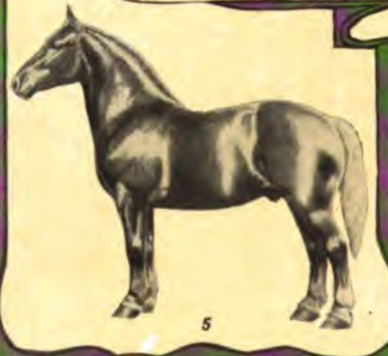
HORSES

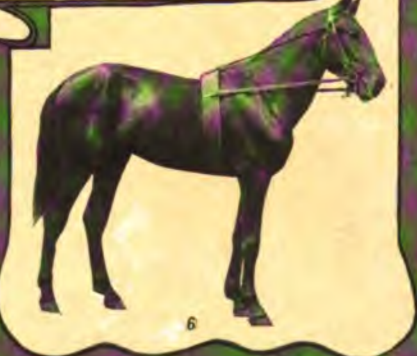


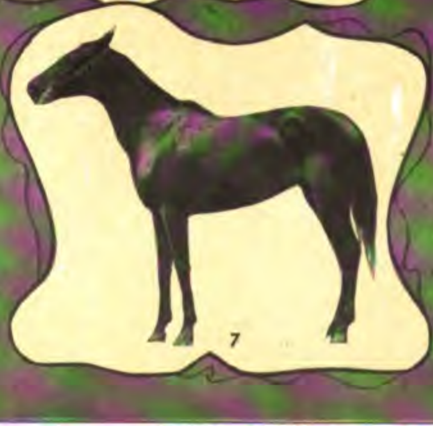


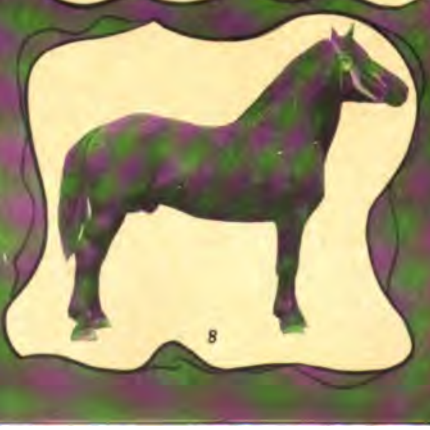












1 English Running Horse
2 English Coach Horse
3 Morgan Trotting Horse
4 Percheron
5 Percheron
6 Wilkes-Hambletonian Trotting Horse
7 American Thoroughbred
8 Belgian Stallion

and the Belgian draft animals are highly esteemed in the United States. The standard English draft-horse is the shire, 16 to 17.2 hands, and weighing 1,800 to 2,300 pounds. They have stout legs, a large head, are broad between the eyes, have a neck well arched, full chest, straight back, round body or barrel and large feet, with plenty of hair at the fetlocks. The Clydesdale is not quite as large as the shire, but is more popular in America. They average a little over 16 hands and weigh up to 2,200. Bay and dapple gray are the common colors. The Suffolk or Suffolk punch is an English draft-horse, of 15 to 16½ hands and weighing 1,500 to 1,900. He has slighter legs than either the shire or Percheron and is not much valued on this side of the Atlantic. The Percheron or Percheron-Norman is the handsomest of the draft-horses, and largely imported from France, being used to improve the farm breeds and build up larger animals. They are 16 to 17.2 hands, and weigh 1,700 to 2,200 or more, and are gray, black and white or dappled in color. The Percheron shows his heels in walking and is apt to straddle a bit.

The American trotter, and the pacer, are described under Horse, Trotting and Pacing, and Horse-Racing. The Morgan horse, renowned for his beauty and intelligence, the Hambletonian and the hackney are fully discussed under Horse, Riding and Driving. The saddle horse, the hunter, the roadster and the park horse are not breeds of horses, but horses of any breed adapted to those purposes. A typical roadster is 15.1 to 15.3 hands and weighs 950 to 1150. A good saddle horse has a flat back, weighs 1,000 to 1,100, stands about 15.2 hands and has five gaits: the walk, trot, amble, canter and either a running walk, slow pace or fast trot. He should hold his head up well and appear stylish. The Morgan is a fine type of saddle horse. Any saddle horse that takes hurdles well is called a hunter.

Horses below 15 hands have lesser value. The English call a horse of 14 to 15 hands a hobby; if below 14 hands a Galloway; anything below 13 hands is a pony. The Shetland pony is from 9 to 10.2 hands and weighs 275 to 400 pounds, being valued mainly as a pet, for children's driving. The Indian ponies, descendants of the Spanish mustangs, imported in the 16th century, abound in the Far West, Northwest and in Mexico. They are called mustangs, bronchos and in the Northwest cayuses. They are small, hardy, cheap, and live on almost anything, and will pick up enough to keep them in a new country. The broncho crossed with a thoroughbred makes a good polo pony.

The ordinary cab horse is 15 to 15.2 hands and weighs 1,050 to 1,150. The so-called bus horse is a trifle larger, weighing 1,200 to 1,400. The horses selected for express work are 15.2 to 16 hands and weigh 1,350 to 1,500. For further details of the horse, see articles following.

HORSE, American Thoroughbred. The American thoroughbred is the production of pure breeds imported from England, first during the 17th and 18th centuries. They first found their way into the Old Dominion of Virginia, where they founded a tribe of early racehorses, to which are traced to-day many of the most fashionable pedigrees. From Virginia the thoroughbreds finally found their way into the Carolinas and as far south as Mississippi and Louisiana, and, upon the formation of Tennessee and Kentucky as States, the breeding of thoroughbreds became with them what might be termed an industry.

The early part of the 20th century finds Kentucky in the lead in the production of thoroughbred horses, followed next by California and then by Tennessee. Missouri and Illinois have recently greatly increased their thoroughbred holdings, while both New York and New Jersey produce a goodly number. Many of the other States take rank as fair producers of thoroughbreds, and, in fact, the breed has found its way into every section of the country, even as isolated a State as Oregon annually producing a number of thoroughbred horses.

The requirements of an American thoroughbred horse are that the pedigree contains five uncontaminated crosses, but the average pedigree traces through 16 to 18 crosses, some having as many as 25. Those reaching an origin of a natural Barb source are considered the most fashionable, but many great racehorses have descended from lines unknown to early English or Arabian pedigrees.

Diomed, the winner of the first English Derby, imported to this country in 1799, when he was 20 years old, is classed as the greatest of early importations, and he has left a marked impress upon American pedigrees. The most successful importation of the 19th century was unquestionably Glencoe (imported in 1836) and in later days Leamington ranks the highest. In more recent years, the ranks of the American thoroughbred have been greatly increased by almost unlimited importations from England, France, Australia and other foreign countries, and horses are produced in this country now that are of entirely foreign pedigrees, while there are numerous instances where the first few crosses are strictly foreign lines.

The average height of the early thoroughbred horse was something less than 15 hands, but at this time they average over 15 hands 2 inches and weigh 150 pounds more than they did a half century ago. In individuality, too, the improvement is very marked, the types now being far superior in form to the horses of early times.

In soundness and general service the American thoroughbred has no superior, this being the result of judicious breeding and favorable rearing conditions. The statistics of the American turf (commonly known as Turf Guides) extend over a period of about 40 years, and in this time these records show that the thoroughbred horse has improved some 35 pounds in weight, and also in style and speed. This marked improvement can be attributed to an accepted theory of breeding that like begets like, to intelligent methods of training and to superior riding.

The most favorable condition which has proved so successful in raising the thoroughbred in this country is that he is housed less and has, at all times, access to lands covered by the finest of grasses, which brings his feet constantly into contact with moisture. The frog of the foot, being like a sponge, absorbs this moisture, thus creating a gentle pressure which spreads the hoof. A horse having bad feet naturally favors them, which has a tendency to make bad ankles and tendons on account of their not being freely used and it is a conceded fact that «no foot, no horse.»

In America the horse has been bred more for business than pleasure. The invention of the elliptic spring and the use of American hickory in the production of light vehicles for pleasure and business, together with the development of macadam and asphalt roads, turned the demand from the running to the trotting horse. The first private coach was introduced into New York in 1745; but coaches were scarce until after the Revolutionary War, and not until after 1840, when the light one-horse vehicle came into use, did the changed conditions of travel develop a harness-horse for purposes of business and pleasure. Along with the change in vehicles incident to the evolution of the trotter came as great a change in the style of harness and trappings.

About the beginning of the 19th century there came from the lines of breeding of the thoroughbred, traceable to Flying Childers, Byerly Turk, and the Darley Arabian, Messenger, a gray, stoutly built horse, of wonderful power and stamina, with a slashing open gait, fitted to found a race of trotters. He was foaled in 1780, and became the progenitor of the trotting families in America. In 1793 Justin Morgan was foaled, sired by one believed to be thoroughbred. Three of his sons, Bulrush, Sherman and Woodbury, became noted as the sires of horses of intelligence, courage and speed, and the get of some of them excelled as roadsters and stage horses. From Black Hawk Morgan, sired by Sherman out of a fast trotting English mare, has come the beautiful, useful and courageous line of Morgans. The original horse (2.40) died in 1856 at the age of 23. In 1849 was foaled Rysdyck's Hambletonian, the founder of the most noted family of trotters, sired by Abdallah, who traced to Messenger by both the sire and dam, out of a dam by Bellfounder, with Messenger crosses on the dam's side. As early as 1876 the interest in breeding and rearing trotters had become so great that fabulous prices were paid for colts, simply on the strength of their breeding. Two fillies, untrained, sold for $13,000. The three-year-old colt, Steinway, was sold for $13,000 in 1879. Maud S., bred at Alexander's noted stock farm in Kentucky, was sold to Mr. Bonner for $21,000 when four years old, with a record of 2.10¼, and the title «Queen of the Turf.» Smuggler sold for $40,000, Pocahontas for $45,000, Goldsmith Maid for $36,000, Dexter for $36,000, and so on, until we come to Axtell, who was sold for $100,000 after he had eclipsed the time of all stallions, and retired to the stud, where his service fee was $1,000. The stallion, Rysdyck's Hambletonian, was purchased with his dam for $125, and earned in the stud $205,750. Thirty-six of his get trotted in 2.30 or better, and the prices for which they could have been sold in their best days amounted to $325,000. Among them were Sentinel, George Wilkes, Jay Gould and Administrator, all noted sires. Their united progeny was worth many thousands for stud and track uses. Some of his sons, without a 2.30 record, became successful in the stud. Alexander's Abdallah was sold for about $3,500, but he got Goldsmith Maid, who made a record of 2.14, and won on the turf close to $250,000; Almont sired 22 2.30 trotters; Belmont got nine with records better than 2.30. So the descendants of Alexander's Abdallah have been worth to their owners hundreds of thousands of dollars. Volunteer was another who ranked among the most successful of the noted Hambletonian sires, having to his credit 23 2.30 performers. Electioneer, bought by Governor Stanford, proved a noted sire, getting the fastest yearling, 2.36½; the fastest two-year-old, 2.21; the fastest three-year-old, 2.19½; and the fastest four-year-old, 2.18¾. The bracing climate of Palo Alto, and the methods of handling peculiar to Governor Stanford's breeding farm, aided in these accomplishments. These are but a few of the thousands of good horses that owe success to the Hambletonian blood. The value of trotters has been measured largely by their speed, taken as a measure of ability to win future races, or as evidence of blood lines that will make the animal valuable in the stud. Success in campaigning is undoubted evidence of pluck and stamina; and the breeding and training of the trotter, and his contests on the track, have developed these qualities in so high a degree that no other class can equal him. The evolution of the trotting horse has also shown the value of a training peculiar to America as a factor in breeding.

It is pertinent to notice that in the first years of the last century running races became common in the Middle and Southern States, while a strong sentiment against racing prevailed in the Northern States. In 1820, Pennsylvania, for example, not only forbade racing, but also enacted that no person should «print or cause to be printed, set up or cause to be set up, any advertisement mentioning the time and place for the running, trotting or pacing of any horses, mares, or geldings,» etc. A similar law was in the statutes of Connecticut until within 30 years. New York passed an act to prevent horse-racing 19 March 1802, which was amended 30 March 1821, permitting the «training of pacing, trotting and running horses» in Queens County for five years. The sheriff was required to be on hand to witness these «trials of speed,» as called in the statute. This amendment was re-enacted 3 April 1826, without a time limit. In 1825 the New York Trotting Club was organized, with a view of «improving the speed of road horses.» This track was probably the first trotting course in the world. The Hunting Park Association was formed in Philadelphia in February 1828, and the next year a trotting club was organized in Baltimore. These facts show a changing public sentiment and the records begin to fall. The keeping of records became an established custom as early as 1829, when the *American Turf Register* began. The English had not then begun to keep records, but the American custom has enabled us to mark the development of speed and establish well-defined breeds during the threescore and more years it has been in use. Wallace's *American Trotting Register* was started in 1871 by J. H. Wallace, New York, since which time the business of breeding trotters has increased, until now it is estimated by good authority that the number of registered standard-bred trotters exceeds 150,000. In the early history of the record many animals were admitted to registry that are not now classed as standard-bred. The term «standard» indicates to-day ability of one or more ancestors to trot within 2.30.

Before the days of macadam roads and light vehicles, saddle-horses were as common as trotters are to-day. They were of no particular breeding, but traced to the thoroughbred, the Narragansett pacer or the Scottish Galloway. Herbert suggests that they were of Spanish origin, their ancestors coming from Cuba. There is now some slight revival of interest in the saddle-horse as a luxury. From the ideal set up, especially in Kentucky, it is safe to predict that there will soon be an improved breed of American saddle-horses.

Prior to the introduction of railroads Vermont had what Herbert called a distinct breed of cart-horses. He described them as «the models of what draft-horses should be, combining immense power with great quickness, a very respectable turn of speed, fine show, and good action.» They had «none of the shagginess of mane, tail and fetlocks which indicates descent from the black horse of Lincolnshire,» and none of the curliness of mane and tail which marks the Canadian or Norman blood, and were characterized by short backs, close ribbing up and round barrels. The only other breed of American horses we have to notice is the Conestoga, which before the days of the Pennsylvania Railroad was common on the farms and highways of Pennsylvania. It seems to have descended from the stock brought by emigrants from Flanders, Denmark and Germany. It was a mixture of several breeds, resulting in a large, patient burden bearer, held in high esteem by the Germans of that State. Although we have not originated and permanently established any American breed of draft-horses, the number of heavy horses has greatly increased, and the quality has improved. The increasing heavy business of factories, jobbers, importers and transfer and express companies in our well-paved cities has called for a great number of powerful horses. This demand has led to the importing of heavy horses from France, England, Scotland and Germany. The Vermont cart-horse and Conestoga draft-horse excelled the types of foreign heavy horses, as a rule; and it is to be regretted that our pride in American animals has not led our people to perpetuate and further develop these useful horses. Tens of thousands of dollars have been sent abroad since the fad of importing heavy elephantine horses became common in the Western States. The enterprising importers scoured France, England, Scotland and Germany for the heaviest animals. They imported more than they could sell, and then adopted the plan of leasing stallions for a term of years. Since 1890 there have been many disastrous failures among this class of importers. There were, however, several importers who imported the best type of the draft and heavy coach breeds to be found abroad, establishing breeding farms not excelled in the world. The earliest importer of high-class draft-horses was Edward Harris, of Moorestown, N. J. In 1839 he imported two mares and the stallion Diligence, who was in many respects similar to the McNitt horse, but heavier and more compactly built, being a little over 15 hands high. The next valuable importation was made by Charles Fullington, of Union County, Ohio, in the spring of 1851. He bought and brought home from France the famous Louis Napoleon, a «short-legged, closely ribbed, blocky and compact gray, three years old.» In 1853 he was sold to A. P. Cushman, of De Witt County, Ill., and after his colts in Union County proved his worth, a company was formed for importing other horses of his type. The author of the ‹Percheron-Norman Stud-Book› says of him that he was undoubtedly the best-known and most popular French horse ever brought to America. The first importations west of the Wabash were made in 1868 by W. J. Edwards, of Chicago, in the great stallions Success and French Emperor. The latter went to Iowa as the property of Hon. J. B. Grinnell. Success was sold to the Fletcher Horse Company, of which M. W. Dunham, of Wayne, Ill., was an active member. In 1874 he purchased the entire interest of the company, establishing his celebrated importing and breeding farm at Wayne. Success's colts at the average age of two years and eight months sold at the average price of $450 per head, and in 1874 alone the sales of his get amounted to $36,000. The Clydesdale has been the strong rival of the Percheron-Norman; is popular in Canada, and has numerous representatives in the Northwest. The secretary of the American Clydesdale Association, Alexander Galbraith, says: «No importations into the United States appear to have been made until about 1870 and 1872, when John Reber, of Lancaster, Ohio, and the Fullingtons, of Union County, began the work. From that date small importations were made by various parties, the most prominent being the Powell Brothers, of Shadeland, Pa. Importations steadily increased up to 1888. Among the larger breeders in America are Colonel Holloway, of Illinois; N. P. Clarke, of Minnesota, and R. B. Ogilvee, of Wisconsin. These three breeders have among them about 175 brood-mares, and have the very cream of Scotland both in blood and individual merit. As high as $10,000 has been paid for one Clyde. Many volumes of the ‹American Clyde Stud-Book› have been published, containing 10,000 entries.» The Shire horse is little esteemed in Canada, but in the American craze for heavy horses he finds admirers. See HORSE-RACING; HORSE, TROTTING AND PACING.

MILTON YOUNG,
Lexington, Ky.

HORSE, Care and Diseases of the. Breeding.—As *heredity* is the basis of all permanence in breeding and *variation* the condition of advancement, we can, under intelligent selection, environment and control, attain to a constant improvement. In selecting horses for breeding, certain leading principles must guide. These may be shortly stated as: (1) adaptability to the use of the breed; (2) quality, style; (3) strength, endurance; (4) good conformation; (5) good constitution; (6) good pedigree; (7) prepotency; (8) no violent crossing of equally prepotent animals; cross the desirable prepotent animal on a non-prepotent cross-bred animal; (9) a speedy amelioration of a large number is most certainly obtained through a prepotent stallion, which leaves a large number of his offspring every year; (10) sound, vigorous health; the prepotent parent must be at his best, and no non-prepotent one should be bred to him, none that is old, feeble or reduced by disease, overwork, underfeeding, etc.; the lack of prepotency will not prevent the transmission of the systemic weakness to the offspring; (11) secure an environment calculated to enhance the qualities we seek in the progeny. Systematic exercise that is not exhausting, generous tissue forming, but not fat forming regimen, and pure, dry, genial but bracing air are especially important.

Contagion Through Sexual Congress.— Many maladies may be transmitted during coition, but some are especially liable to be so. Dourine, glanders, genital eczema, contagious acne, horse-pox, mange and contagious abortion are to be specially guarded against. Some, like strangles, influenza and contagious pneumonia, may be transmitted by an animal that has already passed through the disease and acquired immunity. Special care, therefore, or even veterinary supervision of horses devoted to breeding is a desideratum.

Care of the Pregnant Mare.—Exercise is a valuable provision too often neglected. Free range on breeding ranches, or, for valuable mares, separate paddocks, secure this, while working mares are better to continue the work, provided it is not unduly straining nor jarring, nor productive of excessive fatigue, exhaustion or debility. This maintains appetite, digestion, assimilation, muscular tone and vigor, favors the development of a stronger, better foal, and keeps the dam fitter for foaling and nursing. Feed well, avoiding what is hard of digestion or liable to cause impaction, indigestion, fermentation, or, above all else, diarrhœa. On good pasture grain may be omitted, unless in the last month of gestation or if the mare is visibly running down. Good, clear, sound oats or barley, or bran mash with some boiled flaxseed may be given, and heating agents like maize, buckwheat or wheat avoided. During gestation violent purgatives and active diuretics are liable to bring on abortion.

Care of the Foal.— To avoid danger to both mare and foal in parturition, provide a roomy box-stall with door opening outward, or a paddock. The foal born indoors is always in danger of infection through the raw surface of the navel. The common or box-stall swarming with microbes is more to be dreaded than exposure to stormy outside. When severe weather forbids foaling outdoors, the box should be thoroughly cleansed, disinfected and whitewashed to obviate this danger. Navel infection may cause simple inflammation, swelling and abscess, or the germ may propagate itself through the inactive umbilical vein to the liver, causing infective hepatitis with abscesses or necrosis; or reaching the bowels, it causes infective diarrhœa (white scour); or it may colonize the joints, as infective arthritis (joint ill); or again it may cause pneumonia or multiple abscesses in different organs. The gravity of the resulting disease varies with the infection, and a deadly germ, located in a stable, is liable to attack all foals that come later in the season. Both stable and navel should be disinfected. The foal should be delivered on clean straw, which may be sprinkled with carbolic acid. The navel-string may be severed with an emasculator previously cleaned and boiled or tied with a carbolized new cord painted with tincture of iodine, and, when dry, dusted with tannic acid impregnated with iodine and carbolic acid.

The new-born foal may have the back (flexor) tendons contracted so as to stand over at the knee and fetlock, and in the worst cases the extensor pedis tendon, the opponent of these, is found to be divided across and the muscle wasted and degenerated. A succession of such cases in the same stable suggests infection. Slight cases will recover under splints and bandages, while for more severe ones an aseptic surgical operation may be required. The foal should have the first milk (*colostrum*) to clear away tenacious bowel contents and prepare for healthy function. A mild laxative of raw linseed or olive oil may be requisite in the absence of colostrum. In the absence of the dam's milk the foal may be raised on cow's milk reduced by adding one-third boiled water and sugar to sweeten. After two or three weeks the undiluted cow's milk may be allowed. The cow should be free from tuberculosis.

For the pure bred racer or trotter the foal should have half a pint of oats daily at a month old, to be increased with his growth. Even draft breeds are benefited by such early grain-feeding.

Exercise is essential to the growing foal. The quality of bone, muscle, brain and other parts depends largely on physiological use, and rich blood, active digestion, and assimilation, vigorous health, strength and endurance are incompatible with confinement and inactivity. This may at first be secured by freedom to play in pasture or by careful handling and training by a judicious manager. But to put the two-year-old into a severely contested race, or full training, or to devote the draft colt to regular work, is but to invite disaster. The bones are as yet too soft, they contain too much organic matter and too little mineral, the muscles lack firmness and power of endurance, the whole system is immature and imperfect, and overtaxing exhausts or deranges the functions, and direct injury or impaired development is the natural result.

CARE OF THE FEET.

Overgrown Hoofs.— With unlimited exercise on firm ground, the unshod foot is sufficiently worn down, but when confined for months indoors or in a limited straw yard overgrowth occurs, especially at the toe, and a dangerously increased strain is thrown on the joints, ligaments and back tendons. Distorted and twisted feet, bruises of the sole by the ingrowing heels and quarters, ringbones, ossified cartilages, sprains of the flexor tendons, and diseases of the fetlock, pastern and coffin joints are common, and irreparable results. The feet exposed to this should be frequently pared and adjusted. Remove excess of toe, reduce and balance the inner and outer sides of the wall, file or cut to the level the incurving heels and quarters and round off the sharp outer edge of the hoof. Dry, imprisoned plates of horn pressing up on the sole must be set free and removed. But do not file the surface of the hoof-wall. This removes nature's protective covering and exposes open horn tubes to exhale moisture, and conduces to dryness, brittleness, shrinking, compression and inflammation of the sensitive parts, atrophy and lameness.

Defective Growth of Hoof.— Imperfect growth of hoof may arise from shoeing, pinching, filing, paring, etc., to excess, but also from compulsory idleness. The circulation inside the hoof is greatly accelerated by the ascent and descent of the foot within the horny box in action, and a free blood supply in a healthy tissue favors growth. Life at pasture on firm ground tends to abundant, strong, tough, durable hoof, while close confinement in a stall makes for a thin, friable, brittle and shrunken horny covering. Constant soaking in water softens the hoof. reducing its tenacity, and tending to flattening of both wall and sole. The Belgian. and other horses bred on wet, swampy ground generally show large, flat, pliant and most undesirable hoofs. Such feet are especially liable to thrush, canker, corns, bruises, grease and laminitis. Feet habitually resting on piles of reeking manure in stalls, sheds or yards suffer the additional injury of softening and disintegration from the ammonia gas, and attacks by the swarming putrefying microbes which abound in such material.

Good hoofs, beside use and care, depend on generous living. The fuller growth on the spring and summer grass, forming a permanent ring, illustrates this. Daily washing of the hoof is important, and a subsequent smearing with an ointment of tar and vaseline or oil is useful in preserving the natural moisture and preventing the attacks of microbes.

Shoeing.— For good feet shoes may be dispensed with on soft ground or mud roads, but they become necessary on hard roads and for hard-worked animals. Tips, extending back to the broadest part of the foot only, are the least objectionable. Full sized shoes are too often made to pinch, distort, bruise or injure the foot beyond repair; and a poor foot is as injurious to a horse as an unstable foundation to a building. The first consideration is the preparation of the foot, giving due balance to heel and toe, inner side and outer, sole and wall, heel and bars. While removing all overgrown wall and bars, and all sole-plates that have become detached from the tough living horn beneath and now act as foreign bodies, the tough horn itself should not be exposed, nor removed except as a thin margin around the outer edge, where it is smoothed to the same level as the wall, to which it acts as a support, and the bearing surface of which for the shoe it slightly extends. The outer surface of the wall must be spared abrasion by the file, with consequent drying and contracting as already noticed. Shoes should be removed and reset every four weeks at the utmost, to avoid pinching, setting in, bruising and other injuries. Intelligent shoeing, conserving the feet, goes far to obviate diseases of the feet, the most common and harmful of equine diseases. Among these may be specially named corns, bruises, pricks, quittors, sandcracks, thrush, canker, sidebones, laminitis, navicular disease, contracted hoof, cleft hoof, dry hoof, crooked hoof, loose wall, hollow wall and graveling. As the integrity and easy normal function of the foot is one of the best means of protection against distortions and diseases of the various joints of the limb, it follows that the preservation of sound feet by good shoeing and intelligent care is one of the greatest desiderata in horse management.

FEEDING AND DIGESTIVE DISORDERS.

The natural food of the horse is *grass* and though charged with excess of water, and at first liable to scour, and always to cause flaccid muscles and lack of energy and endurance, yet a run at pasture, with pure air, normal, easy exercise, and stimulation of stomach, liver, bowels, metabolism and excretion will often improve or arrest infirmities of digestion, assimilation, elimination and even innervation. Heaves (broken wind), chronic bronchitis, various forms of nasal discharges, indigestion, torpid liver, gall stones and kidney affections are examples of maladies which improve at pasture. Dried grass in the form of hay is the standard food of the domesticated horse. This is best from natural pastures with a mixture of grasses to be followed by blue grass, timothy, ryegrass and clover, the latter being the most dangerous as a horse feed. Upland hay is more aromatic and choice than that from low, damp or irrigated meadows, and the first crop is always the best. New hay will sometimes disagree, while the old, though lacking aroma and less palatable, is less likely to cause digestive disorder. At a year old and over it is brittle, dried, more fibrous and less nutritive. Badly cured hay is always innutritious and often directly poisonous, when altered by bacterial ferments, molds and their products. The results are shown in heaves, gastric disorders, liver troubles, brain affections (staggers), kidney and skin diseases. Second crop hay, clover and alfalfa hay are especially dangerous in this sense, the excess of proteids in the last two and especially of foliage, delaying curing and favoring the multiplication of ferments. Oats are the standard grain feed for horses. But like hay they must be well matured on good soil, and well cured. Mustiness brings essentially the same evils as in hay, and newly harvested they are liable to disagree. Kiln-dried oats are to be avoided, also those that have sprouted. The composition of oats and hay shows the excess of proteids, carbohydrates and fats in the first.

	Water	Proteids	Carbohydrates	Fats	Cellulose	Salts
Meadow hay	14.59	10.11	40.90	2.34	25.52	6.54
Oats	14.3	12.0	60.9	6.0	10.3	3.0
Maize	10.6	10.3	70.4	5.0	2.2	1.5

Maize is notorious for the deficiency of proteids relatively to the carbohydrates and fat. With a great excess of heat and energy producing constituents and a deficiency of earthy salts it is less calculated to foster growth and development and predisposes rather to fat. It tends more to impactions of the bowels and indigestion, with the resulting skin eruptions, and above all to the destructive recurrent inflammation of the eyes, which ruins so many young horses. Yet it is fed over large areas as the exclusive grain feed, and such is the adaptability of the living system that the minimum evil results. To obviate the evils it can be fed with cooling, laxative agents as wheat bran, carrots or turnips, or an ounce of Glauber salts may be given daily.

Barley, rye and wheat have been successfully fed to horses, but are not equal to oats in supporting the animal and fitting for hard work.

Beans, peas and other leguminous seeds are fed when a horse is subjected to an extraordinary strain of work or endurance, being especially valuable for the excess of proteids they contain. They should be thoroughly matured and dried as the fully formed and partially ripened seeds of several species contain a narcotic poison.

The relative amount of hay and oats for a horse of 1,000 pounds live weight may be stated as follows: *Cavalry horse:* Oats 12 pounds, hay 14 pounds. *Carriage horse:* Oats 10 pounds, hay 12 pounds. *Draft-horse:* Oats 15 pounds, hays 12 pounds. The horse at rest can live on a mere maintenance ration sufficient to keep up bodily temperature and repair waste. A horse in active work will need about one-half more. For very severe or rapid work about one-third more must be added. For hard work a broad ration-proteids 1, to carbonaceous matter 6, is preferable to a narrow ration-proteids 1. to carbonaceous matter 3. An economical feed can often be made of a number of agents compounded from their known chemical composition, to form such a balanced ration, but mere chemical ingredients are not final, as palatability and adaptability have still to be reckoned with and a given weight of oats is of more value than an equal amount of similar nutritive elements in wheat or barley.

Good judgment and regularity in feeding and watering are essential to success with any feed. Feeding in irregular amounts at varying intervals and with uncertain watering will undo the good effects of a generous ration. The small stomach (16 quarts) cannot admit a large feed of oats and saliva without suffering, and, if overdistended, it becomes paretic or torpid and dangerous fermentation and gaseous distension may ensue. Again, if feeding is delayed the hungry craving and nervous excitement cannot be undone by a generous feed later. Then again, if the perspiring and exhausted animal be allowed to slake his thirst with a bucket of ice-cold water, he may have heart failure, or colic, or gastric congestion with sympathetic skin eruption or laminitis, or inflammation may attack any organ that has been previously weakened.

An excellent appetizing food is molasses. This has been largely neglected because of the mistaken idea that it contained heat producing elements only. But corn carbohydrates furnish energy to the acting muscles and other tissues as fuel does to an engine, and sugar, having no need of digestion, can supply force with less loss than can starch or fat. Not the least of its good qualities is the relish with which it is taken and that it imparts to other less attractive food taken with it. For the horse, otherwise healthy, but debilitated by poor or faulty feeding or overwork, molasses is to be depended on to restore weight and energy alike. For this purpose it may be given in the amount of two pounds per day, and even in double that amount if subjected to severe work.

Overdistension of the Stomach.— Sudden inflation of the stomach with gas, the product of fermentation in unwholesome contents (frosted grass, roots, apples, green potatoes, overripe ryegrass, millet, vetch, etc., irritant plants); from overfeeding (at the cornbin in ripe grain, etc.), from violent exertion on a full stomach, or from a full feed when debilitated from starvation, disease or overwork, is liable to cause death in two hours or a little more. The horse can rarely vomit, or belch gas, the stomach does not absorb and the outlet by the bowels is 100 feet long, so that the organ is usually ruptured with fatal results. Among the other less rapid disorders are catarrhal inflammation of the stomach, intestinal colic, congestion, inflammation, impaction, twisting, invagination. calculi and worms. Of poisons may be named: lead through water, etc.; molds, fungi and bacteria in food (causing gastric, intestinal, hepatic, pulmonary, nervous, cutaneous or kidney diseases); ergot, smut (causing gastric disorder, ulcers of the mouth, abortions, etc.); lupines, Senecio Jacobœa (causing cirrhosis of liver); astragalus, oxytropis (loco, brain disease); equisetum (gastric and intestinal catarrh) to which may be added cicuta, conium, œnanthe, aconite, rhus, ranunculus, larkspur, anemone, digitalis, wild cherry, wild onion, camas, helenium, hyacinth, clematis, thorn apple, colchicum, belladonna, hyoscyamus, bitter sweet, euphorbium, hellebore, wild parsnip, laurel, oleander, etc.

Liver Diseases.— These are notoriously prevalent in hot, damp regions in horses kept in close stables on rich, abundant feeding; in such as have dry feeding and scarcity of water in winter; and in such as have a poorly balanced ration with excess either of proteids or of heating carbohydrates. In damp tropical regions special care is needed as to the site, exposure, ventilation and purity of stables, the dietary, exercise and grooming to obviate liver complaints. Transient fevers, nervous, digestive, skin and kidney disorders often originate from troubles in the liver.

Grooming is most important in the finer breeds of horses in clearing off oil and dandruff, rendering the skin pliant, and favoring secretion, exhalation, cooling and elimination. On the contrary, animals at pasture and exposed to cold and wet find a measure of protection in the sebaceous and thick hairy covering. When, however, drenched with perspiration or rain, and in a warm air, the relaxing effect on the skin and general system is very debilitating, hence clipping may become a necessity to be followed by special precautions against cold. The active friction (massage) of grooming renders circulation active, especially that of the lymph, relieving fatigue, favoring elimination and improving the tone of the muscles and general system. The heels need particular care. Clipped heels are irritated by the stubby hair in the folds back of the pastern often precipitating chaps and grease which would have escaped in the unclipped. The heel is normally protected by the abundance of sebaceous secretion, but when this is rubbed off by dust, clay, sand, etc., the part suffers readily from cold, wet, dried gritty mud or other irritants. Washing the heels, especially with caustic soap, and leaving them to dry in cold air or draft is hurtful. Prompt drying of the heels will obviate the danger, and, if there is already any swelling, gentle massage with a little vaseline will improve the condition. In obstinate cases the source of the trouble may be sought in disorder of digestion, liver or kidney.

Many disorders of the nervous system, lungs, skin, eye and kidneys are due to constitutional troubles which cannot be dealt with here in general terms. Such diseases are usually manifested by elevated body temperature and accelerated or modified breathing or pulse. The temperature of the healthy, mature horse, at rest in a cool or moderate environment, is 99° to 100° F., respirations 10 to 12 per minute and pulse 35 to 45.

Contagious Diseases.— These agree in one fundamental feature that each is due to a microbe, which passes more or less directly from the affected animal to the sound one, thus propagating the disease. The arrest of the epizootic and even its complete and final extinction is merely a question of preventing such transmission and of destroying every infecting germ. This truth is not yet duly appreciated by stock-owners, legislators nor sanitary officers, but when it is fully realized we shall be near the total extinction of most animal plagues to the unspeakable profit of humanity. The *Contagious diseases* may be divided into two classes: (1) Those in which the infection is either confined to solipeds, or mainly propagated by the equidæ, so that its extinction in these would mean the final extinction of the disease, and (2) those which are propagated in other genera as well, so that the extinction of the germ in other species also would be essential to its complete eradication.

To the first class belong strangles (distemper), contagious pneumonia, equine influenza, glanders, tetanus, vesicular exanthema, contagious acne, petechial fever, gastro-enteritis of the new born, South African horse sickness, dourine, surra, Nagana, Mal de Caderas, infectious paraplegia. The first four of these affections are constantly spread in the United States through sales, public stables, stockyards, railroad cars, ships and sale-stables, and no radical measure is taken to destroy the germs in such infected places, or to prevent the infection of all solipedes that pass through them.

In the second class must be included: Horse-pox, contagious abortion, thrush of the mouth, infectious ophthalmia, tuberculosis, rabies, malignant œdema, anthrax and emphysematous anthrax. The first six of these are propagated more by other genera than the horse, so that the burden of the work for their extinction would have to be expended on these other classes. The last three are caused by germs which can live out of the animal body in the soil, and their extinction would involve the drainage and sanitation of the infected soils as well.

Shipping Fever.— In the matter of communicable diseases of horses, unfortunately, some one thought the name *shipping fever* as a profitable one to exploit. It embraced not only all contagious and communicable diseases, but all caused by parasites, and all due to exposure, accidents, changes of food and water, to impurities of air and to a thousand other insanitary conditions. Confining it to contagious diseases affecting the breathing organs alone it would cover glanders, all forms of infectious sore throat, complaints of the nasal passages, of nasal sinuses, of the Eustachian tubes and middle ear, of the tonsils, of the thyroid glands and parathyroids, of the thymus, of the long chain of lymph glands adjoining the nose, mouth and air passages generally, equine influenza, the different kinds of communicable pneumonia,— fibrinous, mycotic, aspergillous, croupous, diphtheritic, verminous, brustseuche, bronchitis, broncho-pneumonia, pleuropneumonia, pleurisy, tuberculosis, etc. The sellers of curative and protective serums had thus to provide the means of contesting the field with scores of anti-serums, each claiming to be the deadly enemy or antidote of one particular brand of the many microbes and microbian poisons (*toxins*) that operate in producing and maintaining the many transmissible affections of the breathing organs. But as they had taken the first step toward assuming to provide the world with an antidote for the whole conflicting group of destructive affections, something that could be blindly used for all alike, they felt obliged to carry out, in form at least, their reckless promise that their product would answer equally well for any disorder that could be classed rightly or wrongly as a shipping fever. They did not dare delay long enough to consider that to produce a *real antidotal serum* for each of the many diseases named they must keep, at their laboratories, a large number of animals suffering from each separate malady, from which they could draw at frequent intervals the fresh, active and trustworthy antidotal products necessary to deal with and control this form of infection, and that the animals under each infection must of necessity be so closely shut in and cared for that by no possible unlucky chance could the infinitesimal infection they carried escape through visitor, instrument, parasite, wind, breath, dust, insect, secretion, fodder, manure, etc., so as to carry infection to anything outside. They did not consider that the laboratory animals must be guarded with similar care after as well as before they have yielded up their protective material. It was formerly supposed that a quarantine of 40 days was sufficient for the death and disposal of any living disease-producing germ, and that the subjects could then be set free to mingle safely with other susceptible animals. But this illusion no longer holds sway. Many germs (glanders, syphilis, tuberculosis, etc.) continue for a lifetime in the bodies of their victims ready to infect others; many others, if frozen, dried or shut up from light, moisture, electricity and air, maintain their vitality and virulence for months and years in the bodies of such victims. But our serum vender is out for commercialism and is not to be hindered by small matters; he has already compressed the many diseases due to trading into one problematic (but utterly indifferentiated) *shipping fever*, he can just as easily offer a polyvalent (multivaluable) serum guaranteed to protect against the whole of the different diseases involved. He can go a step further still: as the Department of Agriculture has been appointed to inspect, supervise and license firms that make prophylactic and curative serums he can call upon this department to inspect and endorse his polyvalent serum and so secure the requisite guarantee that will procure him a large sale. The buyers of live stock naturally trust to the knowledge of their government and use the commercialized material on a large scale. Only a certain percentage of the horses traded in a district were both susceptible and exposed to a disease existing in that district, so that a large number remained for which the traders could secure certificates that the animals had been treated with this prophylactic and had escaped or survived the prevailing disease. Like the live stock insurance company, trusting to the fact that a given class of animals must increase in numbers or be abandoned, they exacted a premium on each animal that would on the whole more than compensate for the average losses under ordinary conditions and yet leave a handsome surplus for themselves. Prior to the advent of the deadly cattle plagues in Great Britain (Rinderpest and Lung plague) these live stock insurance companies were very prosperous, but after their coming the institutions got into difficulties and were driven to the wall. Their main use was to distribute and average the losses over the whole country. They did little or nothing to remove the causes of the loss. Very nearly a similar experience was had in the would-be immunizations against the deaths from shipping fever in horses. So long as trading was comparatively restricted, the fact that the so-called shipping fever comprehended over a score of different diseases, each with its own specific microbe, its own deadly toxins and its own protective materials, it was easy to get evidence of tens or hundreds of thousands of protective inoculations and of immunizations from the pest. Nothing was easier than to collect these from pest-free areas. But when the demand arose for army horses for the unprecedented war in Europe, the hollowness and falsity of this evidence was quickly revealed. The whole continent was laid under contribution for suitable horses, they were shipped from every available locality in railroad cars to collecting centres, infecting shipping places, stables, sheds, pastures, auction yards, watering and resting places, cars, and finally destination camps and transports; further infection entered through fodder, litter, grain, blankets, combs, brushes and other appliances until each rendezvous of army horses became a veritable pest-house. We cannot leave out the strongly contributing causes attendant on the haste of shipment. The purchases were crowded into cars, good and bad, open and closed, and fresh from the quiet of the fields they were exposed to the terrors of railway travel, the continuous and intermittent explosions of escaping steam, the whirring and plunging of moving wheels, the constant movements and straining to restore the disturbed equilibrium, the jamming against confining walls, and jerking of limiting halters and slings, the attempted or accomplished kicks, blows and bites of neighboring horses, the uncertain steps on bare wet floors. The constancy of this unceasing turmoil and strain, the undeniable imminence of danger, of injury and even of death, throws the nervous horse into a condition of mental excitement and physical fever, which enormously decreases its capacity of resistance to disease whether from constitutional or microbian enemies. Add to this that the animal, while in the greatest state of excitement, overstrain and exhaustion, aching in overworked muscles, flushed with hurried breathing and circulation, drenched it may be with perspiration, is delayed for many hours in the burning rays of a summer sun from which he cannot protect himself by change of position, or subjected to the rapid motion of 50 miles an hour or more, with no available shelter from the coldest head wind or the chill of rain or snow, and no one can be surprised at the severe illnesses brought on by physical suffering and climatic vicissitudes, altogether apart from microbian invasion. But how much more if the microbian invader is also present, urgently seeking an animal system already below par in which it can begin its deadly work. Some army veterinarians (Turner) are disposed to charge the shipping fever losses mainly, if not altogether, on the unsanitary physical conditions of the shipping, and to seek for the much needed relief in the improvement of these conditions. A large amelioration could unquestionably be secured by this means, but with the fatal drawback of blinding the eyes to the real cause of each of these shipping maladies, the specific microbe, which is the ultimate, essential cause of any one of the pestilential disorders that propagates itself without limit from animal to animal. Moreover, the pestilential microbe readily acquires a greater or lesser virulence and potency according to the conditions in which it exists, so that although we could diminish, or even for a time abolish, the fatality and loss in a given district, yet if we failed to definitely destroy and thoroughly exterminate all of the microbes of each particular disease we would be in a sense but preserving the disease-seed against the time when it could propagate itself anew in a less sanitary environment. We have sad examples of this continually before our eyes in the present mode of dealing with hog cholera, tuberculosis, anthrax, blackleg and a great variety of other plagues. The only rational and universally effective remedy, for the transmissible microbian pest, is one that involves the complete and permanent extinction of all microbes that keep the particular pest going. Anything short of this is a make-shift at best, and must in the end fail to give us a perfect and enduring success. In the obnoxious conglomeration now masquerading under the name of shipping fever the first consideration should be to quarantine all districts wherein anyone of its dangerous list of diseases exists. This should include, not only animals susceptible to the disease in question, but other animals that have in any way come into contact or near proximity, or, secondarily, into relation with the infected or suspected animals endangered through food, litter, manure — solid or liquid — or through coverings, harness or implements used in connection with such animals or their products, and particularly through persons attending to the suspected animals and handling their food, litter, manure or other products. Vermin that live in or visit the premises must be destroyed, and all predatory animals — rats, mice, weasels, skunks, mink, squirrels, woodchucks, buzzards, eagles, falcons, hawks, vultures, owls, crows, rooks, etc.— must be disposed of. If quarantine is needed at all it must be instant and absolute; any concession or day of grace is but a sacrifice of the most important public right, and the person granting it can only be looked on as a criminal and should be dealt with accordingly, as an enemy of the public, of the live-stock industry and of the first principle of sanitation. The area quarantined must be wide enough to exclude any possibility of the escape of infection. The quarantine of a few more herds on suspicion (precaution) is a very temporary evil at the worst, which will be corrected when the short period of incubation has passed without any infected cases, whereas the omission of but one infected herd and the spread of the germ by shipment, sale or otherwise, would perhaps have become the cause of utterly unnecessary and incalculable losses and might even have placed the resulting outbreak beyond the reach of permanent control. The first wrong step by an official appointed to take effective measures against infection cannot fail to make a second and even worse step easier, and will do much to undermine the confidence and morale of the stockowners generally, to encourage the evil disposed to oppose and circumvent the best extermination measures and to turn an easy success into a failure. A census list of quarantined animals, identified by indelible markings, must be kept, also a record of every death and the mode of disposal of the carcass, also a heavy penalty imposed for every animal missing. No permission to drag out a carcass to be exposed unburied (or unburned) can be permitted or neglected. Thorough sterilization by boiling in water is ideal, as preserving the carcass-values for fertilization, or otherwise, without any possible escape of infection, would be effected. Thorough disinfection of the premises where the animals are shut in and of all products of the animals is quite as essential. The standing rule is safety with conservation. In all self-limiting affections the survivor would recover immune, so that no elaborate nor expensive immunization method need be adopted. An attack of the disease itself followed by recovery gives the subject the most reliable protection. But an animal may have become itself immune and yet may remain a carrier of the disease-germs and prove dangerous to every susceptible subject he may meet, and thus start new outbreaks wherever he may go. Such an immune bearer of a deadly infection may be tested and detected by one of the various laboratory tests (agglutinin, precipitin, complement fixation, antigenetic action, hemolysis, etc.). But any such test is open in this case to the objection of the multiplicity of the germs found in different cases of shipping fever, of the delay and cost of so many different tests made in turn, to the constant temptation to stop short of completing the many successive tests for the diseases involved, when all the materials for the different tests are not at hand and cannot be at once commanded; — this temptation would be especially trying in the case of the many numbers of animals in a polyvalent serum manufactory, where so many animals are needed to be kept under the many diseases necessary to furnish the requisite amount of defensive and immunization products to protect against the 20 or 30 different affections and microbes to be dealt with in the different forms of shipping fever. All the more is this trying when it is taken into account that the polyvalent serum making is commercialized; that an urgent demand has come through the exigencies of war; and that this must be met at any cost. Need we wonder that when it thus came to a great nation-wide demand and test, under bad sanitary conditions, that the serum proved a dismal failure?

A rigid, inflexible quarantine of a duration covering the length of incubation found in any of the maladies, in the complex shipping fever would be a rational alternative with the unspeakable advantage of being a successful one; it would make an end of the disease (diseases) in the existing areas of prevalence, would purify our markets for horses, the supplies of which would no longer come already-infected, and those that had passed through the disease (diseases) and recovered would come themselves immune from such disease, and such as come to the markets infected would furnish the means of tracing the offending microbe back to its source and of bringing the sellers up for lawbreaking. This would be a telling step toward the extinction of all such plagues in the land.

An important co-operative resort would be the adoption of the auto-therapy referred to in the article on CATTLE AND THEIR DISEASES. The first step in this would be to isolate, quarantine and disinfect all equines, showing any suggestion of any one of those diseases now disguised under the misleading name of shipping fever. Not in foul and infecting railway, market nor shipping yards, but in clean, open pasture if the weather is fine, or in pure, airy buildings, with good exposure in severe weather. This guards owners, shippers, railways, cars, ships, etc., against complicity in spreading infection, and places a wholesome responsibility on every one handling such stock. Any suspicious symptom in stock sent is indicative of complicity. Among disinfectants, freshly made bleaching powder is usually the most available, efficient and cheap with the drawback of injuring the fertilizer, but it may be replaced by others (formalin, carbolic acid, copperas, etc.). Some mild antiseptics (graduated sulphur fumes, eucalyptol, naphthaline, thymol, lime sulphide, etc.) may be used on the respiratory, or digestive mucous membranes, or on the skin. Laxatives (Epsom or Glauber salts) may be used with judgment to counteract constipation, and diuretics (nitrate of potash) to correct suppression of urine. The auto-therapy is sought by the use of the blood serum of insusceptible animals (healthy ox, sheep, swine) taken by the mouth, nose-douche or better subcutaneously, or by the serum of the immunized horse hypodermically, or again the blood serum of an animal already under the disease, after it has been Pasteurized or sterilized by heat (212° F.). This may be used subcuteno. The serum of the infected has these great advantages of avoiding the blunders and risks that attend on the use of the polyvalent serum which may or may not contain the defensive matters of the particular disease we are now contending with, but which (if really polyvalent) ought to contain those belonging to a large number of other diseases of the shipping fever group and we cannot be quite sure that it does not contain some of the living germs. By taking the blood from the infected or suspected (exposed) animal before us for treatment, we can get no germ that is not already in its body or in its fellows, and we thus run small risk of inoculating with germs more deadly than they now possess. We thus greatly restrict the complexity of our problem and largely invite good results. By sterilizing, however, at the temperature of boiling water we get rid of all disease germs, leaving no living microbe to propagate itself in the body of the animal we are now dealing with, and thus adding to the force of any disease actually present in its system. Some of the defensive and poisonous bodies present in the infected blood, like alexines, are oftentimes robbed of their potency by the boiling, but a large number of others retain their activity, which is largely antagonistic to the microbe and when used in moderation are beneficial to the case. Those products that are even transiently hurtful or dangerous are the toxins and other poisonous proteids, which in excess and in addition to those already in the system might temporarily aggravate the disease-conditions, but, on the other hand, these are among the desirable elements in stimulating the body cells, especially the white cells of lymph, blood and tissues, to increase the production of the elements that really antagonize the disease-microbes. Even these toxins and proteids therefore must be looked upon as highly important in drawing out from the guardian and defensive body cells that which opposes the attacking microbes and their poisons. In using them indirectly we enlist in our service the native, inherent defensive powers of the body attacked. In the infected (attacked) body of our subject these defensive elements have already been increased, and now, by the guarded use of the poisons of the microbe, we are soliciting a further increase of the protecting and reparatory compounds, where the dead microbes are no longer able to increase their own numbers and poisons. The degree to which this may be pushed will depend on the violence of any attack in hand, the excess of the microbian chemical poisons already present in the animals' system, and the amount of the self-defensive power still remaining in that system. This power it is, in which we must place our trust for recovery, hence the importance of taking our patient in hand at the earliest possible moment after it has become infected. We can judge this condition largely by the morbid symptoms shown, but it is always well to use the clinical thermometer on all the subjects before us and to hasten the treatment for all such as show by a rise of temperature that the system is already under the sway of the disease. We cannot hope that under all circumstances we shall succeed, but we are working in strict accordance with nature's own laws and the sooner we can take the case in hand, and the more judiciously we can check bacteridian increase, and stimulate systemic defense the greater may be our hope of a final success.

Parasitic Diseases.—A number of parasites that prey upon solipeds can live indiscriminately in other animals as well. Among these may be named the *Tricophyton* of ringworm; *Aspergillus* of pneumomycosis; *Actinomyces:* different species of wood ticks; *Dermanyssus* of poultry acariasis; *Trombidium Americanum* (and *F. Holosericium*); *Linguatula Denticulata; Eustrongylus Gigas; Filaria Medinensis; Distoma Hepaticum* and *D. Lanceolatum*. By reason of their variety of hosts these would be less easily got rid of. But another list includes the obligate parasites which must live in the soliped at some stage or perish. These accordingly can be extinguished on the same principle as can the microbes of exclusively equine plagues. They include the larvæ of four species of botfly (*Œstrus Equi, Œ. Hæmorrhoidalis, Œ. Pecorum* and *Œ. Nasalis*); three lice (*Hæmatopinus Marcrocephalus, Trichodectes Pilosus* and *Tr. Pubescens*); four mange acari (*Sarcoptes Scabei V. Equi, Psoroptes Communis V. Equi, Symbiotes Communis V. Equi* and *Demodox Folliculorum V. Equi;* three tapeworms (*Tænia Perfoliata, T. Mamillana* and *T. Plicata*); two stomach worms (*Spiroptera Microstoma* and *Sp. Megastoma*); five intestinal worms (*Ascaris Megalocephala, Oxyuris Curvala* and *O. Mastigodes, Sclerostoma Equinum* and *Sc. Tetracanthum*); one of the serous cavities (*Filaria Papillosa*); one of the lungs (*Strongylus Arnfieldi*); and four of the blood (*Filaria Hæmorrhagica, F. Irritans, F. Sanguinis Equi* and *F. Reticulata*). For the obligate parasites their extinction on the victim and his removal from the source of a fresh supply means a final extinction of the parasite, as the worm cannot be perpetuated without its host. In the case of worms, which survive as eggs and embryos in damp earth and water, the exclusion of solipeds for a year or two from infested stables and fields, from waters (ponds, lakes, wells, streams) that receive drainage from infested places, and from food derived from such verminous localities, entails the inevitable destruction of these parasites in such habitat outside the body. An essential condition of complete success is that the infested animals must be themselves cleared of the worms, to prevent their colonizing new places with the parasitic, and, in the case of such as are entertained in the blood, or serous cavities or in cysts in the tissues, this takes time to allow of their migrating into the bowels or reaching their limit of life and perishing. The mere use of anthelmintics or vermifuges alone is no radical treatment for these parasites. A veterinary sanitation which is far reaching enough to do away for all time with the class of contagious and parasitic epizootics, is the only one worthy of 20th century knowledge, or which will fulfill the duties of the age.

James Law,
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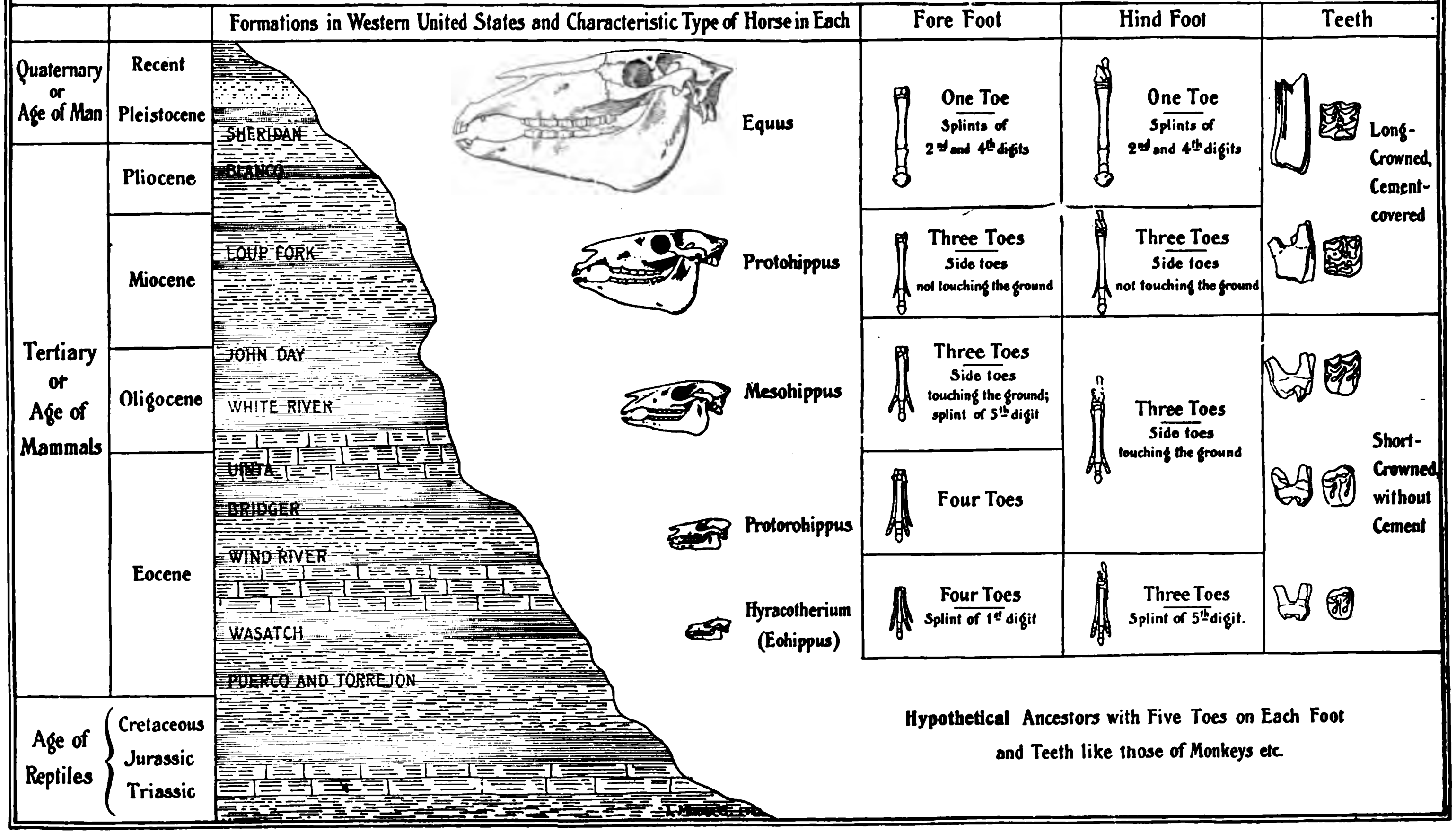
HORSE, Evolution of the. As a domestic animal the horse is to be found almost everywhere that man can live. He is spread all over the world — from torrid to arctic climates, in all the continents, in remote oceanic islands — he is completely cosmopolitan. But as a wild animal the horse is limited to the Old World, and is found there only in the open arid or desert plains of central Asia and Africa. There are two species in Asia, the Asiatic wild ass (*Equus hemionus*), and the little known Przewalsky's horse (*E. przewalskii*), while in Africa there are the African wild ass (*E. asinus*) and the several species of zebra (*E. zebra, E. burchelli, E. quagga*). In the Americas and Australia

THE EVOLUTION OF THE HORSE.


Formations in Western United States and Characteristic Type of Horse in Each
Fore Foot
Hind Foot
Teeth
Quaternary or Age of Man
Recent
Pleistocene
Tertiary or Age of Mammals
Pliocene
Miocene
Oligocene
Eocene
Age of Reptiles
Cretaceous
Jurassic
Triassic
SHERIDAN
BLANCO
LOUP FORK
JOHN DAY
WHITE RIVER
UINTA
BRIDGER
WIND RIVER
WASATCH
PUERCO AND TORREJON
Equus
Protohippus
Mesohippus
Protorohippus
Hyracotherium (Eohippus)
One Toe
Splints of 2nd and 4th digits
One Toe
Splints of 2nd and 4th digits
Long-Crowned, Cement-covered
Three Toes
Side toes not touching the ground
Three Toes
Side toes not touching the ground
Three Toes
Side toes touching the ground; splint of 5th digit
Three Toes
Side toes touching the ground
Short-Crowned, without Cement
Four Toes
Four Toes
Splint of 1st digit
Three Toes
Splint of 5th digit.
Hypothetical Ancestors with Five Toes on Each Foot and Teeth like those of Monkeys etc.

there are no true wild horses, the mustangs and broncos of the Western plains and South America being feral (domesticated animals run wild) and descended from the horses brought over from Europe by the early white settlers. When the Spaniards first explored the New World they found no horses on either continent. The Indians were quite unfamiliar with them and at first regarded the strange animal which the newcomers rode with wonder and terror, like that of the ancient Romans when Pyrrhus and his Greeks brought elephants to fight against them.

The horse is distinguished from all other animals now living by the fact that he has but one toe on each foot. Comparison with other animals shows that this toe is the third or middle digit of the foot. The hoof corresponds to the nail of a man or the claw of a dog or cat, and is broadened out to afford a firm, strong support on which the whole weight of the animal rests. Behind the «cannon-bone» of the foot are two slender little bones, one on each side, called *splint-bones*. These represent the second and fourth digits of other animals, but they do not show on the surface, and there is nothing like a separate toe. So that the horse may be said to be an animal that walks on its middle finger-nail, all the other fingers having disappeared.

The teeth of the horse are almost equally peculiar. The molars are long, square prisms which grow up from the gums as fast as they wear off on the crowns. Their grinding surface exhibits a peculiar and complicated pattern of edges of hard enamel between which are softer spaces composed of dentine and of a material called «cement,» much like the dentine in quality but formed in a different way. The dentine is formed on the inside surfaces of the enamel while the tooth is still within the jaw-bone; the cement is deposited on the outside surfaces of the enamel after the tooth has broken through the jaw-bone and before it appears above the gums.

Various other peculiarities distinguish the horse from most other animals; some of these are shared by other hoofed animals. The two long bones of the fore-arm (*radius* and *ulna*) are separate in the greater number of animals, but in the horse, and in many other hoofed animals, they are consolidated into a single bone. The same consolidation is seen in the bones of the lower leg (*tibia and fibula*). The lengthening of the foot and stepping on the end of the toe raises the heel in the horse, as in many other animals, to a considerable height above the ground, where it forms the hock joint, bending backward, as the knee bends forward. In these as in various other ways the legs of the horse are especially fitted for swift running over hard and level ground, just as its teeth are for grinding the wiry grasses which grow on the open plain.

The zebra and the ass have the same peculiar structure of teeth and feet as the domestic horse, and differ only in the color of the skin, proportions of various parts of the body, etc.

Fossil Horses of the Age of Man.— In the early part of the Age of Man, or Quaternary Period, wild species of horse were to be found on every continent except Australia. Remains of these true native horses have been found buried in strata of this age in all parts of the United States, in Alaska, in Mexico, in Ecuador, Brazil and Argentina, as well as in Europe, Asia and Africa. All these horses were much like the living species and most of them are included in the genus *Equus*. A complete skeleton of one of them (*Equus scotti*) was found by the American Museum expedition of 1899 in northern Texas. The difference between it and the domestic horse is chiefly in proportions, the skull shorter with deeper jaws, the legs rather short and feet small in proportion to the body. In these characters this fossil horse resembles an overgrown zebra rather than a domestic horse. We know nothing of its coloring. It may have been striped and in this case would have been very zebra-like; but there are some reasons for believing that it was not prominently striped. The bones are petrified, brittle and heavy, the animal matter of the bone having entirely disappeared and having been partly replaced by mineral matter. They are not much changed in color, however, and are so perfectly preserved that they look almost like recent bone.

All the remains of these native horses which have been found in America have been petrified more or less completely; this means that they have been buried for many thousands of years, for petrifaction is an exceedingly slow process. It serves as an easy method of distinguishing them from bones of the domestic horse, found buried in the earth. These cannot in any case have been buried for more than four or five centries, and have not had time to petrify. Remains of these fossil horses are found in various parts of the United States, chiefly on the Niobrara River in Nebraska, and in central Oregon, Many separate teeth and bones have been found in the phosphate mines near Charleston, S. C.; other specimens have come from central Florida, from southern Texas, Arizona, Kansas, Louisiana and even from Alaska. They are, in fact, so often found in deposits of rivers and lakes of the latest geological epoch (the Pleistocene) that the formation in the western United States has received the name of Equus Beds.

In South America, in strata of the Pleistocene Epoch, there occurs besides several extinct species of the genus *Equus*, the *Hippidium*, a peculiar kind of horse characterized by very short legs and feet, and some peculiarities about the muzzle and the grinding teeth. The legs were hardly as long as those of a cow, while the head was as large as that of a racehorse or other small breed of the domestic horse. All these horses became extinct, both in North and South America. It may have been that they were unable to stand the cold of the winters, probably longer continued and much more severe during the Ice Age than now. It is very probable that man — the early tribes of prehistoric hunters — played a large part in extinguishing the race. The competition with the bison and the antelope which had recently migrated to America, may have made it more difficult than formerly for the American horse to get a living. Or, finally, some unknown disease or prolonged season of drought may have exterminated the race.

In central Asia, two wild races persist to the present day; others were domesticated by man in the earliest times, and their use in Chaldæa and Egypt for draught and riding is depicted in the ancient mural paintings. In Africa the larger species became extinct in prehistoric times, as in America, but the smaller zebras still survive in the southern part of the continent (one species, the quagga, abundant 50 years ago, is now probably extinct), and the African wild ass is found in the fauna of the northern part. The wild horse of prehistoric Europe, a small race, short-legged and shaggy-haired, was domesticated by man, a fact that is known from the rude drawings scratched on bone or ivory by men of the Neolithic or Polished Stone Age. But the domestic horse now in use is derived chiefly from the Asiatic race, although it is probable that in some breeds there is a considerable strain of this shaggy, short-legged European race, and it is possible also that African races may have been domesticated and to some extent mixed with the Asiatic species. The domesticated ass is a descendant of the African species.

The Evolution of the Horse.— The history of the evolution of the horse through the Tertiary Period or Age of Mammals affords the best known illustration in existence of the doctrine of evolution by means of natural selection and the adaptation of a race of animals to its environment. The ancestry of this family has been traced back to nearly the beginning of the Tertiary without a single important break. During this long period of time, estimated at nearly 3,000,000 of years, these animals passed through important changes in all parts of the body, but especially in the teeth and feet, adapting them more and more perfectly to their particular environment, namely, the open plains of a great plateau region with their scanty stunted herbage, which is the natural habitat of the horse. In the series of ancestors of the horse we can trace every step in the evolution of those marked peculiarities of teeth and feet which distinguish the modern horse from an ancestor which so little suggests a horse that, when its remains were first found 40 years ago, the animal was named by the great palæontologist, Richard Owen, the *Hyacotherium* or «Coney-like Beast.» Its relation to the horse was not at that time suspected by Professor Owen, and was recognized by scientific men only when several of the intermediate stages between it and its modern descendant had been discovered. On the other hand, this first ancestor of the horse line is very difficult to distinguish from the contemporary ancestors of tapirs and rhinoceroses, and indicates how all the modern quadrupeds have diverged from a single type, each becoming adapted to the needs of its especial mode of life.

The earliest known ancestors of the horse were small animals not larger than the domestic cat, with four complete toes on each forefoot and three on each hindfoot. There is reason to believe that the still more ancient ancestors of this and all other mammals had five toes on each foot. In the forefoot of the earliest known stage we find a splint-bone or small, slender rudiment representing the missing first digit or thumb, which no longer appears on the surface of the foot, while in the hindfoot there is a similar rudiment representing the outer or fifth digit, but no trace is left of the innermost or first digit. The proportions of the skull, the short neck and arched back and the limbs of moderate length, were very little horse-like; recalling, on the contrary, some modern carnivorous animals, especially the civets (*Viverridæ*). The teeth were short-crowned and covered with low rounded knobs of enamel, suggesting those of monkeys and of pigs or other omnivorous animals, but not at all like the long-crowned complicated grinders of the horse.

Commencing with the *Hyracotherium,* 12 stages have been recognized from as many successive formations, showing the gradual evolution of the race into the modern form and each stage is characteristic of its particular geological horizon. Some of the stages have been found in several parts of the world, but by far the most complete and best-known series comes from the Tertiary Bad Lands of the Western States. Besides the main line of descent which led into the modern horses, asses and zebras, there were several collateral branches which have left no descendants. Of some stages all parts of the skeleton have been found, of others, only the jaws, or jaws and feet, are known. We can mention only the more important stages.

1. The *Hyracotherium* is the most primitive stage known, but only the skull has been found, so that it has not been determined exactly what the feet were like. The teeth display six rounded knobs or cusps on the upper molars and four on the lower ones, and these are just beginning to show signs of fusing into cross-crests. The premolar teeth have only one main cusp, except the third and fourth premolars (next the molars) in each jaw, which have two and three, respectively. The only specimens which has been found were in the London Clay or Lower Eocene of England and are preserved in the British Museum.

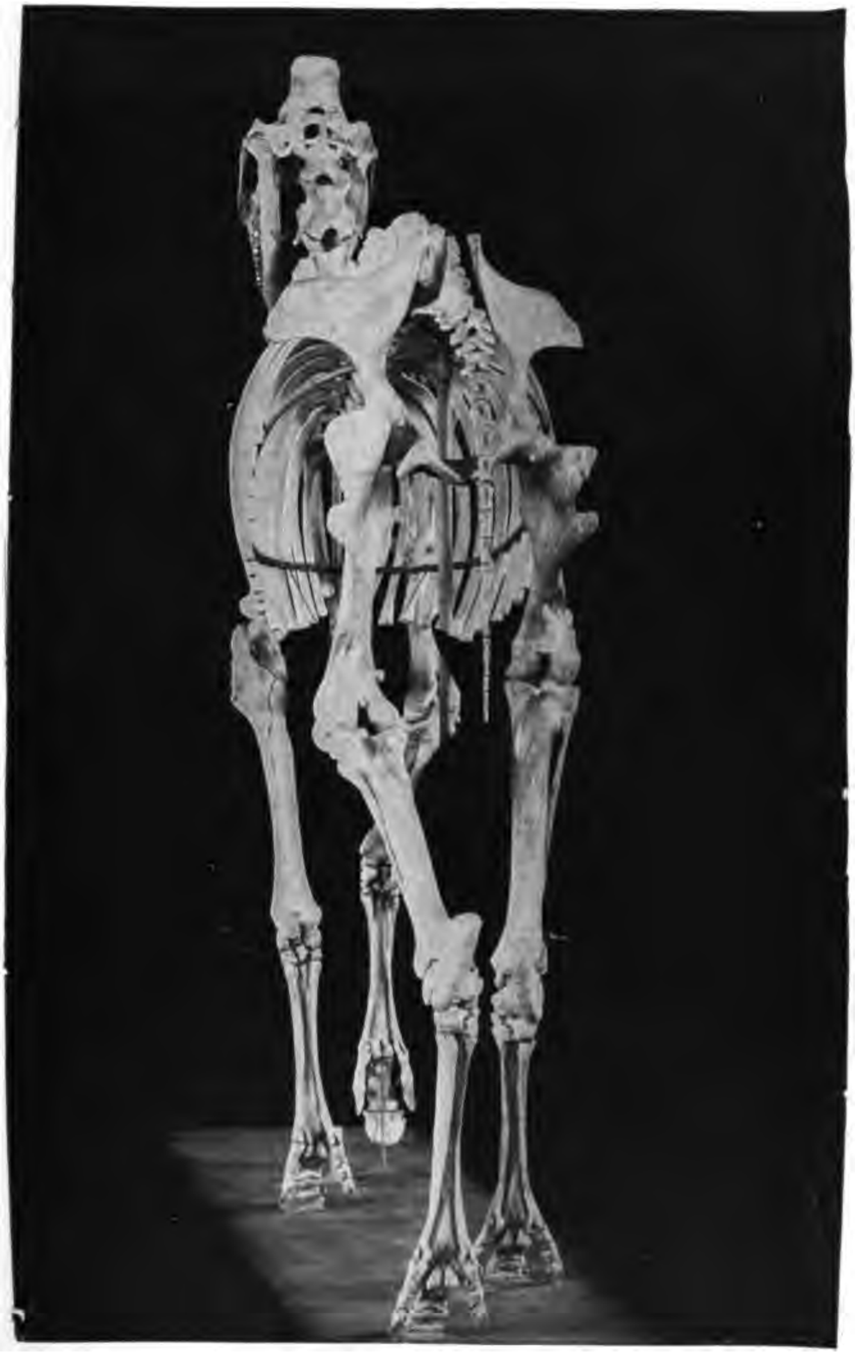
2. The *Eohippus* is much better known. It comes from the Lower Eocene of Wyoming and New Mexico, and is very like the *Hyracotherium* except that the molar teeth have the cusps more clearly fusing into cross-crests, and the last premolar is beginning to look like one of the true molars. The forefoot of this animal has four complete toes and the splint of a fifth. The hindfoot has three complete toes and the splint of another.

3. *Protorohippus.*— In these animals the splint of the first digit in the forefoot and the splint of the fifth digit of the hindfoot have disappeared, but there are still four complete toes in the fore- and three in the hind-foot. The crests on the molars are a little clearer and the last premolar has become almost like the molars, while the next to the last premolar is beginning to become so. A skeleton of *Protorohippus* shows an animal of the size of a small dog, and proportioned much like the breed known as the *whippet.* The *Protorohippus* was found by Dr. J. L. Wortman in 1880 in the Wind River Bad Lands of Wyoming, and was described by Professor Cope and others under the name of the «Four-Toed Horse.»

4. Of *Orophippus* we have only parts of jaws and teeth. A specimen of the forefoot is exhibited in the museum of Yale University.

5. *Epihippus* (*Upper Eocene*).— Of this stage of the evolution of the horse only incomplete specimens have been found. The molar teeth have the once round cusps almost completely converted into crescents and crests, while another tooth of the premolar series has become like the molars. The toes are still four in

HYPOHIPPUS



Courtesy of the Philadelphia Commercial Museums

Skeleton from Middle Miocene Beds, near Pawnee Butte, Colorado

the forefoot and three in the hindfoot, but the central toe in each foot is becoming much larger than the side toes. (This species happens to be somewhat smaller than those found in the Middle Eocene stage, but no doubt there were others of larger size living at the same time). *Palætherium* and *Paloplotherium* of the Upper Eocene of Europe form a side branch. They were very abundant in Europe, but have not been found in the New World. On each foot they had three toes of nearly equal size, and the teeth show a rather peculiar pattern. One of these animals was thought by Professor Huxley to be a direct ancestor of the horse, but it now is considered to be merely a collateral relative. Some species of *Palæotherium* were of large size, equal to a tapir. They were first described in the year 1804 by the celebrated Baron Cuvier from remains found in the gypsum quarries of Montmartre, Paris.

6. *Mesohippus Oligocene* (*White River Formation*).— In this stage there are three toes on each foot, a splint representing the fifth digit of the forefoot of the Eocene ancestors. The middle toe is now much larger than the side toes, which bear very little of the weight of the animal. Three of the premolars have now become entirely like the molar teeth, the crests on the crown are completely formed and the outside crest in the upper molars has taken the shape of two crescents. In the Middle Oligocene is found *Mesohippus bairdi* about the size of a coyote, while in the Upper Oligocene occurs *Mesohippus intermedius* as large as a sheep. Of both these animals all parts of the skeleton are known.

7. *Anchitherium* (*Lower Miocene*).— This stage has been found both in Europe and in America. It is much like its predecessor, but is larger and has the crests of the teeth somewhat higher and more complete. It probably is not in the direct line of descent of the horses, but is on a side branch.

8. *Parahippus* and *Hypohippus* (*Middle Miocene*).— In *Parahippus* the tooth-crests are much higher, and the transverse ridges on the upper molars are beginning to change shape so as to become a second pair of crescents inside the outer pair. *Hypohippus* is off the direct line of descent; its teeth are like those of *Anchitherium*, by which name it has been generally called, but the animal was much larger, equaling a Shetland pony in size. A complete skeleton of the *Hypohippus* was found near Pawnee Buttes, Colorado, in 1901 by Barnum Brown, of the Whitney expedition. In the forefoot of *Hypohippus* small rudiments still remain representing the first and fifth digits, but there is no splint of the fifth, as in *Mesohippus*. The second and fourth digits still touch the ground, though lightly. The feet of *Parahippus* were much like those of *Hypohippus*, but the side toes were smaller.

9 and 10. *Protohippus* and *Pliohippus* (*Middle and Upper Miocene*).— In this stage the crowns of the upper molars have become much longer, the two pairs of crescents on the upper molars are complete, with two half-separated cusps within the inner pair. And the valleys between the crests have become filled with cement, so that with the wear of the teeth the edges of hard enamel are backed inside by dentine and outside by cement. In this way the surface of the tooth has a series of enamel ridges always projecting a little above the grinding surface, because the softer material on each side wears down into hollows, yet never breaking off, because they are braced so thoroughly on each side. This is a very efficient instrument for grinding hard grasses. In *Protohippus* and *Pliohippus*, especially in the former, the crowns of the teeth are by no means as long as in the modern horses; they must therefore wear more slowly or wear out at an earlier age. The feet in these two genera have but one toe touching the ground. The side toes (second and fourth digits) are complete, but much more slender than in the earlier stages and are apparently useless, as they cannot reach the ground. In some species of *Pliohippus* they have almost disappeared. The forefoot of *Protohippus* still retains tiny nodules of bone at the back of the "wrist" (sometimes improperly called in the horse the "knee-joint"), which are the remains of the first and fifth digits.

11. *Hipparion* (*Pliocene*).— This genus, probably also a side branch of the genealogical tree of the horse family, is much like *Protohippus*, but larger and with more complication about the tooth pattern. It is common in the European Pliocene beds and has been found in America also. The feet are still three-toed, the side toes as large as those of the older *Protohippus*.

12. *Equus* (*Pleistocene* and *Recent*).— In this stage, that of the modern horse, the side toes have entirely disappeared and are represented by splints on the fore- and hind-foot. No trace remains on the forefoot of the little nodules which in *Protohippus* represented the first and fifth digits. The crowns of the teeth are much longer than in the last stage, and of the two half-separated inner columns on the upper molars. one has disappeared, the other has increased in size and changed in form. The skull has lengthened and the animal is much larger.

13. *Hippidium* (*Pleistocene. South America*).— The feet are like those of *Equus*, except that they were short and stout. The teeth are like those of *Pliohippus*, from which it is supposed to be descended. The skull is large and long, with very long, slender nasal bones. Casts of the skull and limbs presented by the Museo Nacional of Buenos Aires, Argentine Republic, are exhibited here.

The Change in Feet and Teeth.—Along with the disappearance of the side toes in the evolution of the horse there is a considerable increase in the proportionate length of the limbs, and especially of the lower part of the leg and foot. The surfaces of the joints, at first more or less of the ball-and-socket kind, which allows free motion of the limbs in all directions, become keeled and grooved like a pulley-wheel, permitting free motion forward and backward, but limiting the motion in all other directions and increasing considerably the strength of the joint. By this means the foot is made more efficient for locomotion over a smooth regular surface, but less so for traveling over very rough ground, and it becomes of little use for striking or grasping or the varied purposes for which the feet of polydactyl animals are used.

The increased length in the lower leg and foot increases the length of the stride without decreasing its quickness. The heavy muscles of the leg are chiefly in the upper part, and to increase the length of the lower part changes the centre of gravity of the limb very little. Consequently the leg swings to and fro from the socket nearly as fast as before, since in an ordinary step the action of the leg is like that of a pendulum and the speed of the swing is regulated by the distance of the centre of gravity from the point of attachment, as that of a pendulum is by the height of the bob. To increase the length of lower leg and foot therefore gives the animal greater speed; but it puts an increased strain on the ankles and toe-joints, and these must be strengthened correspondingly by converting them from ball-and-socket joints to "ginglymoid" or pulley joints. Additional strength, likewise at the expense of flexibility, is obtained by the consolidation of the two bones of the fore-arm (*ulna* and *radius*) and of the leg (*tibia* and *fibula*) into one, the shaft of the smaller bone practically disappearing, while its ends become fused solidly to its larger neighbor.

The increase in length of limb renders it necessary for the grazing animal that the head and neck should increase in length in order to enable the mouth to reach the ground. An example of these changes is the modern horse, in which we find the neck and head much elongated when compared with the little *Hyracotherium,* and this elongation has taken place *pari passu* with the elongation of the legs. The reduction and disappearance of the side toes and the concentration of the step on the single central toe serve likewise to increase the speed over smooth ground. The soft yielding surface of the polydactyl foot is able to accommodate itself to a rough irregular surface, but on smooth ground the yielding step entails a certain loss of speed. A somewhat similar case is seen in the pneumatic tire of a bicycle; a "soft" tire accommodates itself to a rough road and makes easier riding, but a "hard" tire is faster, especially on a smooth road. Similarly, the hard, firm step from the single toe allows of more speed over a smooth surface, although it compels the animal to pick its way slowly and with care on rough, irregular ground.

The change in the character of the teeth from "brachydont" or short-crowned to "hypsodont" or long-crowned enables the animal to subsist on the hard, comparatively innutritious grasses of the dry plains, which require much more thorough mastication before they can be of any use as food than do the softer green foods of the swamps and forests.

All these changes in the evolution of the horse are adaptations to a life in a region of the level, smooth and open grassy plains which are now its natural habitat. At first the race was better fitted for a forest life, but it has become more and more completely adapted to live and compete with its enemies or rivals under the conditions which prevail in the high dry plains of the interior of the great continents. The great increase in size, which has occurred in almost all races of animals whose evolution we can trace, is dependent on abundance of food. A large animal, as may be shown on ordinary principles of mechanics, requires more food in proportion to its size than does a small one, in order to keep up a proper amount of activity. On the other hand a large animal is better able than a small one to defend itself against its enemies and rivals. Consequently, as long as food is abundant, the larger animals have the advantage over their smaller brethren and by the laws of natural selection the race tends to become continually larger until a limit is reached when sufficient food becomes difficult to obtain, the animal being compelled to devote nearly all its time to getting enough to eat.

Cause of the Evolution.— The evolution of the horse, adapting it to live on the dry plains, probably went hand in hand with the evolution of the plains themselves. At the commencement of the Age of Mammals the western part of the North American continent was by no means as high above sea-level as now. Great parts of it had but recently emerged, and the Gulf of Mexico still stretched far up the valley of the Mississippi. The climate at that time was probably very moist, warm and tropical, as is shown by the tropical forest trees, found fossil even as far as Greenland. Such a climate, with the low elevation of the land, would favor the growth of dense forests all over the country, and to such conditions of life the animals of the beginning of the Mammalian period must have been adapted. During the Tertiary the continent was steadily rising above the ocean-level, and at the same time other influences were at work to make the climate continually colder and drier. The coming on of a cold, dry climate restricted and thinned the forests and caused the appearance and extension of open, grassy plains. The ancient forest inhabitants were forced either to retreat and disappear with the forests, or to adapt themselves to the new conditions of life. The ancestors of the horse, following the latter course, changed with the changing conditions, and the race became finally as we see it to-day, one of the most highly specialized of animals in its adaptation to its peculiar environment. At the end of the Age of Mammals the continents stood at a higher elevation than at present, and there was a broad land connection between Asia and North America, as well as those now existing. At this time the horse became cosmopolitan, and inhabited the plains of all the great continents, excepting Australia.

It is a question whether the direct ancestry of the modern horse is to be searched for in western America or in the little known interior plains of eastern Asia. It is also unknown why the various species which inhabited North and South America and Europe during the early part of the Age of Man should have become extinct, while those of Asia (horse and wild ass) and of Africa (wild ass and zebra) still survive. Man since his appearance has played an important part in the extermination of the larger animals; but there is nothing to show how far he is responsible for the disappearance of the native American species of horse.

Parallel Evolution in Other Races.— It is interesting to observe that while the evolution of the horse was progressing during the Tertiary Period in North America another group of hoofed animals, the *Litopterna,* now extinct, in South America evolved a race adapted to the broad plains of Argentina and Patagonia and singularly like the horse in many ways. These animals likewise lost the lateral toes one after another, and concentrated the step on the central toe; they also changed the form of the joint-surfaces from ball-and-socket to pulley-wheel joints; they also lengthened the limbs and the neck; and they also lengthened the teeth, and complicated their pattern. Unlike the true horse, they did not form cement on the tooth, so that it was by no means so efficient a grinder. This group of animals native to South America became totally extinct, and were succeeded by the horses, immigrants from North America, which in their turn became extinct before the appearance of civilized man.

Many of the contemporaries of the horse in the northern hemisphere were likewise lengthening the limbs, lightening and strengthening the feet, elongating the tooth-crowns to adapt themselves to the changing conditions around them, but none paralleled the horse evolution quite so closely as did the pseudo-horses of South America. But the camels in America, the deer, antelope, sheep and cattle in the Old World, progressed on much the same lines of evolution, although their adaptation was not to just the same conditions of life.

William D. Matthew,
American Museum of Natural History.

HORSE, The French Coach. The prevailing characteristic of a Frenchman is his devotion to those things that make life pleasant. From an artistic standpoint he leads the world. Pleasure and horses go together. A Frenchman is instinctively a horseman. The French cavalry is without an equal in the world. Since the time of Napoleon the French government has taken charge of the breeding of horses that are best adapted for cavalry uses, and in accomplishing this purpose the government has contributed to the production of a very high-class coach horse. The cavalry horse of France is usually selected after the committee has finished their work of picking out the very best stallions for breeding purposes. Nearly every French coach stallion that stands for public service in France is owned by the French government. The French have been willing to advertise and sell their other breeds of horses, but they have been loath to part with their coach horses. The instinct of self-preservation causes the French government and the French people to keep their French coach horses at home in order to have better horses than can be found in any other country.

The breed of French coach horses has its origin from the same source as the English thoroughbred. On the one hand, the English thoroughbred surpasses in speed, while the French coach horse is superior in all of those qualities that go to make up a high-class carriage horse. Like the Percheron, the French coacher is developed in its highest state of perfection in Normandy, but he comes from the northern part, while the Perche is in the south of Normandy.

The French coach horse is about 16 hands high; his average weight is between 1,200 and 1,300 pounds. His color is as a rule bay, brown or chestnut. His outline is most pleasing. He is a fast trotter, and under the conditions of horse racing in France under saddle over a turf track a distance of 4,000 metres he holds the record. The French method of developing their trotters cultivates a very high, attractive style of action. Not only is the French coacher seen in every French city hauling the most gorgeous equipages over the boulevards surrounding Paris, but he is to be seen in the best stables throughout all of the capitals of Europe, especially in London. The French coacher supplies the English royalty with their most useful and most attractive carriage horses.

For more than 20 years French coach stallions have been brought to America very sparingly. Where they have been crossed with the best road mares, trotting bred mares, the result has been most satisfactory. High-grade carriage horses that go into our best markets and sell for the highest prices usually have a strain of French coach blood flowing through their veins. A perfect type of the French coach horse when standing or in action is impossible to describe in words. To fully realize his superiority, to appreciate and admire his style and magnificent high action, one must actually see him. Words are inadequate to describe him, and the most perfect picture falls far short of the most perfect horse.

John R. McLaughlin.

HORSE, Military. The relative importance of the horse as a factor in the progress of civilization has been somewhat reduced by the introduction of steam and electricity, but mechanical devices such as the bicycle and automobile are not likely to wholly supplant the indispensable ally of man for war purposes. The value of cavalry has not, within the century, been so fully recognized as during the South African campaigns, where the supply of horses reached enormous proportions. The kind of horse for cavalry and artillery use is controlled by the character of service for which he is to be used. Hardy range horses are desirable in a campaign where the question of forage supply is a difficult one, but, if fully armed and equipped men of average size are to be transported and held in readiness for mounted combat with opposing cavalry, then larger and better trained horses are desirable.

The source from which cavalry horses are obtained differs in various countries. Some European nations breed and raise their remounts, while others provide the services of selected stallions gratuitously to breeders, the foals being held subject to purchase by the state. The American plan differs from the European practice and involves only the inspection of such animals as are presented by contractors. This encourages all farmers to breed a fair class of horses, and whenever the requirements of the markets increase the breeding usually increases until prices sometimes fall below a level at which colts can be profitably reared. Only a small percentage of horses raised in the United States are adapted to the requirements of cavalry service. This arises from the preference of the farmer for heavy horses to draw large loads; the cavalry service requires animals of particular conformation and character. The inspection of remounts for soundness and confirmation is a very important duty, demanding technical training and intelligence. It requires judgment, much instruction and long practice to correctly estimate the relative value of various points of the horse and to determine whether the good qualities counterbalance the existing defects. Contractors do not usually present ideal animals, but the market from which they draw is so large that there is no serious difficulty in supplying the remounts annually required for the United States cavalry.

In European armies horses are accepted at four years of age, and sometimes under that age. It has been found in practice in the United States preferable to buy no horses under six years of age for immediate use in field service. Younger horses may be accepted during peace when there is no likelihood of immediate hard service, but they are subject to influenza or shipper's fever to a degree which often renders them unserviceable for many months. The foreign buyers of our horses in 1914, 1915 and 1916 were not as a rule able to get precisely the class of horses they preferred. Good points in a cavalry horse are not mere matters of beauty, but shapes which, on mechanical principles, are likely to answer required ends. Cavalry horses must have certain qualifications, the most important of which are the possession of sufficient mobility to execute tactical manœuvres at varying degrees of speed and the ability to stand hard service while carrying weight. The weight of trooper and equipment averages about one-fourth the weight of the horse Ability to carry flesh under stress of short rations is a commendable quality in a cavalry horse, since it enables him to stand hard work and to avoid a sore back. The requirements demanded in the cavalry horse of the United States are:

"The cavalry horse must be sound and well bred; gentle under the saddle; free from vicious habits; with free and prompt action at the walk, trot and gallop; without blemish or defect; of a kind disposition; with easy mouth and gait, and otherwise to conform to the following description:

"A gelding of uniform and hardy color; in good condition; from 15¼ to 16 hands high; weight not less than 950 nor more than 1,150 pounds; from four to eight years old; head and ears small; forehead broad; eyes large and prominent; vision perfect in every respect; shoulders long and sloping well back; chest full, broad and deep; fore legs straight and standing well under; barrel large and increasing from girth toward flank; withers elevated; back short and straight; loins and haunches broad and muscular; hocks well bent and under the horse; pasterns slanting and feet small and sound." See also HORSE, RIDING AND DRIVING.

HORSE, The Percheron. The Percheron horse is the production of the most patient care and the application of the best scientific principles of breeding. From the dawn of history the French breeders of draft-horses have been most successful, and the horses they have raised have been renowned the world over.

In the 16th, 17th and 18th centuries the same rules of selection in breeding have been applied that prevail to-day. The good horses were permitted to reproduce themselves and multiply. The inferior and unsound ones were never permitted to breed. The result of this most careful selection, based on scientific principles, has given the French the best draft-horse that the world produces.

In a very small portion of Normandy called the "Perche" the highest result has been attained. From this district the Percheron horse has been sent to all parts of the world with such satisfactory results that the word Percheron to-day means the ideal draft-horse the world over. From the very beginning up until the present time the object of the Percheron breeders has been to produce the kind of horse that would move the greatest weight with the greatest speed.

In making their selections for breeding purposes the Frenchmen have not only picked out stallions and mares that would make the best horses, but comely appearance and pleasing outline have also in a measure been their guide, and as a result the Percheron horse to-day is not only the best draft-horse in the world, but he is one of the most attractive. He is indeed a handsome horse. The prevailing color of the Percheron horse is from black to white, including all of the various gradations from black, dark gray, dapple gray, gray and white.

About 50 years ago the first Percheron stallions were imported from France to America, and those that became most famous came to Ohio. One, called Louis Napoleon, owned in Union County, Ohio, and afterward sold to go to Normal, Ill., both here in Ohio and in his new home in Illinois, was admired by all. In a few years, when his colts began to appear, the reputation of the Percheron breed in America was so well established that hundreds and even thousands of them have been imported to America each year.

During the past 100 years the government in France has maintained a system of supervision over the horse-breeding industry. The government does not own every Percheron stallion, but every Percheron stallion must be approved by the government inspectors and must receive a certificate of approval before he can be used for breeding purposes in France. Many of the best stallions belong to the government. Many of those owned by private individuals receive a subsidy from the government if their owner will offer their services to the public.

On account of the very high tariff laws the French breeders supply nearly all of the horses used in France. The ups and downs of prosperity and depression do not affect the horse-breeding industry in that country. Instinctively the French breeders keep their best stallions and mares, no matter what the foreign demand may be, and as long as they pursue this policy the best Percheron horses will be found in France and the best breed of draft-horses in the world will be the Percheron.

JOHN R. MCLAUGHLIN.

HORSE, Riding and Driving. In the latter days of this country one can hardly go to even an insignificant town or village without finding that a number of its residents spend time and money in raising, training and driving as good horses as their means will afford. Another striking feature of this country horsemanship is the rivalry and constant vying of each horse-fancier to excel among his fellows, and the interest manifested to-day in buying, selling and "swapping" horseflesh is typical of the American.

The county and State agricultural fairs which now make the exhibition of horses a special feature are largely the outgrowth of this far-reaching interest in horses. Nearly every country fair has, besides trotting and perhaps running races, a department for harness horses and breeders' competitions. As freight and passenger rates are commonly commuted by the railroads or the fair corporations, these meetings enable the farmer to see the best the country for miles around can produce, raise his standards and teach him the results to be attained by proper breeding.

The horse shows, held annually in many of our large cities, at regular seasons throughout the year, and so arranged that they may not conflict as to dates, invite competitors from all parts of the country, who exhibit what they have with fair prospects of making their expenses from the prize money won. These horse shows are fostered both as sporting and business institutions, and the best horsemen in the country form their directorates and act as judges. These large shows do much to establish the types of animals that meet with favor, and their growth and popularity has cultivated the taste and interest of the general public in horses more than any other factor.

The types of horses highly valued in the large cities and in the country are, of course, similar to a large extent. A good horse is good anywhere. Nevertheless, the requirements of a metropolitan market are much more exacting and extend to the many qualities which we will try to outline in this article. While the country is often satisfied with mere "getting there" qualities in the horse, regardless of how it is done, or perhaps a mere combination of speed and endurance, the standard of a large city calls for certain definite requisites and qualifications — "points" — which are well-nigh indispensable if the horse is to command a good price.

To fill the requirements of the affluent class it is estimated that not more than 5 per cent of the horses throughout the country, including those raised with this object solely in view, can be utilized. Indeed, taste has become so fastidious that the right kind can only be found by diligent search, and prices verge into sums that 10 years ago would have been unbelievable. It must not be thought that the general run of horses in this country, or indeed that the quality of our native bred horses, has deteriorated in the past few years. Such, in the writer's opinion, is not the case. The fact is, that to fill the high requirements of the metropolitan market has become the recognized goal of all horse breeders; and it is now generally understood throughout the country that the market for the inferior horse is limited to those who can afford to pay so little that the breeder is not compensated for his care and outlay in breeding anything but the best. The general introduction of trolleys and the automobile has been an important factor in curtailing the market for horses that are merely "serviceable" and has reduced it to a competitive point that is unprofitable.

The high qualifications for the metropolitan market have reduced the available horses to such a small number that expert buyers search this country and the Dominion of Canada from one end to the other. Buying as cheaply as possible, so thorough has been the scouring of the country that the prices paid would seem fabulous to the seller if the cost alone of raising the horse were taken into consideration. The buyer must also assume the risk and expense of transportation to market.

The "points" for which the breeder is striving are well defined, but the individual may vary so much in combining them that the interesting feature of personal taste remains as the determining factor in selecting horses for personal use.

Heavy-Harness Horse.— The term "heavy-harness horse" is a general one. Under it may be classed anything from the 12 hand pony for basket-phaeton or village cart, through the various types suitable for the runabout, gig, brougham, victoria and other vehicles that fashion prescribes for various uses, to the 16-1 hand carriage horse for pulling the capitalist's omnibus.

The importation into this country, since 1883, of English hackneys and the exhibition of them has undoubtedly done much to educate the public to a type of carriage horse. While no disparagement is intended to the standard bred trotting horse, whose origin, indeed, is allied to the hackney — although his later history is somewhat different — the serviceable, short backed, straight-legged and intelligent horse now the standard for metropolitan use is nevertheless nearer the hackney type than the old style American trotter. It should be stated, however, that very few either of the trotters or hackneys of 25 years ago would generally fill the requirements of the harness horse to-day. A type having been once well established, however, horses filling the requirements can be selected from carefully bred trotters as well as from hackneys, and one breed is often mistaken for the other, such is their closeness in resemblance and the result of breeding with particular ends in view. The elements to be taken into consideration in the harness horse are as follows: Conformation, manners, action, speed, color, size and age. Conformation ranks first in point of importance, but manners are an absolute essential also. These two although somewhat variable must be present in any horse required for harness; the others vary considerably according to the type and weight of the vehicle to which the horse is to be harnessed and the purchaser's personal taste.

The elements in the order of their importance from a purely selling point of view are:

1. Conformation as to head and neck. This is probably the first feature the average purchaser will look for. The horse should possess a small head, delicately molded nostrils and a small tapering muzzle. His jaw-bones should be well apart so that when the head is reined in they will not interfere with his breathing. He should have good sized eyes, well separated; a narrow forehead or small eyes being general indications of lack of intelligence, nervousness or a tendency to fright or bad temper. The ears should be small and well apart. The neck should be gently tapering and well cut out in the throat, and the so-called "crest" from which the mane grows should have the slight convexity which indicates strength, maturity and condition. The neck should be set on sloping shoulders so that the head will be naturally held erect, turning upward from the forward line of the trunk nearly perpendicular. A tapering neck is an indication of breeding and fineness as distinguished from the coarseness of draft blood and the common horse in ordinary use.

2. Conformation as to legs. The general requirements are that all four legs shall be approximately straight and not too long. A moderately short-legged horse is generally preferred, both for looks and service, to one that depends upon long legs for height. The forelegs should be perpendicular when the horse is standing erect, bones flat, but not heavy or coarse. The hind legs, when in a natural position, should be so formed that a plumb line dropped from posterior point of the haunch will be nearly tangent at the point of the hock, the rear line of the leg below the hock being approximately parallel to the plumb line. The thighs should be moderately heavy at the height of the lower line of the trunk. The modern idea is that the horse's buttocks should be round and muscular viewed from behind. The pasterns of all four legs should be springy and long rather than short.

3. In general. The horse should be "close-coupled"; in other words, there should not be too much space between the last rib and the quarter. His trunk should be round and just fleshy enough so that his ribs may be felt — not seen. Standing on level ground the height of his withers and croup should be about the same. The trunk, directly under the withers, should be deep and the chest from the front view broad, giving room for the heart and lungs and an appearance of power. The belly should be well picked up beneath the kidneys with a gentle, convex, upward curve from between the front legs — not enough, however, to produce the waspy effect sometimes seen in horses otherwise well formed. The back should be short, lending to the trunk an appearance of compactness and solidity. The quarters should not fall away back of the kidneys more than an inch or so to the root of the tail. The tail, if set well forward of the posterior line of the horse's haunches, is generally admired, and in this position will be carried at the proper angle naturally.

Under the subject of *manners*, full technical treatment should be sought in various books relating to horse training and breaking. We will endeavor to point out, however, to what extent manners in a harness horse is supplemental to ordinary training; to treat the subject fully being like attempting to describe what a gentleman should do under all circumstances. A few salient points will perhaps give a fair indication of the general subject.

The well-mannered horse should be so trained that when bitted his head is carried almost vertical, and close to his neck, which will be gently curved; the head and neck taken together being straight with the line of direction in which he is traveling. This position is not only graceful but gives the driver the utmost command over him. He should "fill his collar" without urging, but be light mouthed and susceptible to the slightest hint from the reins, voice or whip. He should be afraid of nothing and possess sufficient intelligence so that after first acquaintance with motor vehicles, railroad trains and other startling objects, he will pay no attention to them.

Into this subject, therefore, the question of natural disposition necessarily enters, as without a sensible but willing and high-strung disposition, it is impossible to produce a fashionable carriage horse. The horse should be trained to back and turn for the voice or with the slightest pressure of the reins without manifesting any disposition to shake his head or bore upon the bit. Plunging, rearing or trickiness must be absolutely eliminated, so that he is safe for a lady to drive through crowded city streets. He should be broken single, double and tandem, and to the saddle for convenience sake, and should be ready at any moment to serve in any one of these capacities.

All this mannering constitutes a supplemental or post-graduate education, for the horse as delivered from the country is broken but commonly utterly devoid of manners. To accomplish this a training extending over a period of as much as three months is often necessary even with a horse that would be considered thoroughly broken in the country; and after mannering him as to how he shall carry his head and respond to the driver, it is necessary, so perfectly must the horse be trained to suit the metropolitan purchaser, to spend a week or more in thoroughly accustoming him to city pavements and sights. It is almost superfluous to state that many horses cannot be brought to this high state of perfection, but the question of manners enters very largely into the price consideration, and the schooling should be carried on to as high a point as the disposition of the individual will admit.

While *action* is not absolutely indispensable, it is nevertheless the feature that many amateur horsemen will look for first, often neglecting much more important points to secure the flashiness of the high actor. Many dealers say, "Give me action and I can sell anything." Without going to this extreme, it is undoubtedly true that high action will cover many sins, and if a horse will only "get his head up and act" he is apt to be salable. Without action speed seldom attracts the city purchaser, and while it is undeniable that high action, except with careful driving and stable attention, will often cripple a horse on hard pavements who might otherwise go sound for years, the average high-price buyer not only asks for clean, straight action, but verges to the danger point in its height. The expert will seek horses having action both in front and behind as he knows that without hock action, little, if any, speed will be produced, the propelling force lying in the power of the thighs. He will look at the horse going, coming and sideways, first to see that the horse neither toes in, paddles or interferes in front; second, to see that he keeps his hocks close together as they pass, and consequently does not "straddle" or place his hind legs at the extreme forward stride outside of the line taken by his fore legs, or interfere by brushing either fetlock joint; third, that he does not forge and that his action is even when looked at from the side, each leg advancing at a stride the same distance and height as the corresponding leg on the other side.

The only gait admissible in the heavy harness horse is a trot. Pacing, racking, single-footing or any gait other than a square line trot, by whatever term it may be called, have no place in the metropolitan market. The horse should strike out straight from the shoulder in front, the whole leg straightening at the instant the hoof touches the ground, the hoof striking flat. The straightened foreleg then passes under the body of the horse and is rolled up when it leaves the ground, the hoof nearly touching in extreme cases the point of the elbow joint, While still «folded» the arm bone reassumes the position for the next forward stride. As indicated above, the action of any single leg and hoof should be in a single longitudinal vertical plane. Some writers have endeavored to demonstrate, by projecting upon a longitudinal vertical plane the arc described by the forward point of the hoof from the time the horse picks up his foot from the ground until he touches it again, that the ideal action thus projected would form a symmetrical arc of an ellipse. While it is conceivable that such may be the case, it is practically impossible to determine slight variations from this ideal, and if the horse acts high, clean and straight without interference or forging he will not generally be open to criticism.

The modern buyer looks more and more nowadays for strong hock action, which means that the horse will cover ground and retain much of his action regardless of the amount of weight behind him.

While *speed* is not a very important element in horses for carriage use, it would be a truism to state that people like to go fast, and of two individuals equal in other respects, the purchaser will prefer the horse that has the most «step.» A discriminating dealer will commonly aim to secure horses than can go a mile under ordinary circumstances in three and one-half minutes, and if possible in three minutes. This is, ordinarily, quite fast enough for salability, and the horse that will «road» steadily at 10 to 12 miles an hour and can increase the speed a little for a short spurt fills the market requirements pretty fully.

In *color*, modern fashion prescribes bays, chestnuts and browns, a dark seal brown being perhaps the most popular. Golden chestnuts are also popular, and blood bays are in high favor. Very few purchasers will consider a white or black horse, regardless of any number of other good qualities. Grays, except of the dark dapple variety, are rarely used, except in a cross-matched pair, and then only as a matter of personal fancy. In a road coach four, however, they are approved by the best authorities.

The amount of white on a horse is a matter of personal taste, many people liking white fetlocks and a star, stripe or blaze on a chestnut or bay's head, others preferring solid color. Bays are generally most popular with black points, but in general it may be stated that the horse possessing too much white will not please. One or two white legs, with white extending a short way to the knee or hock, will not be objected to, but it can be stated positively that, except for a leader or wheeler in a road coach team, where a showy effect is desired, there should be no white upon the body of the horse.

A sleek, shiny coat is a recommendation for any horse, as it usually bespeaks condition and breeding.

The question of *size* is one that is a matter of personal taste primarily, and secondly, one of suiting the vehicle to which the horse is to be harnessed. The salable horse for ordinary city use is rarely under 14½ hands, and in the opinion of most judges should not exceed 16¼ hands. For a lady's phaeton a small team with considerable substance and not usually less than 14½ hands in height is required, and for a heavy omnibus sufficient weight and strength are usually secured in the horse whose height does not exceed 16 hands. The most salable size for horses in general use is about 15–2½ hands. Most buyers will restrict their purchases to horses between 15–1 and 16 hands, unless the animal is very remarkable in other respects, because customers for extremes in size are few in number, and such horses are consequently less readily salable.

A word should be said as to the *age* of the marketable horse. It is pretty well understood that colts suitable for heavy harness do not attain maturity and maximum strength until they reach the age of five or six years, and the ordinary purchaser will prefer the six-year-old horse. From 7 to 10 years the horse is at his best. While some horses hold their good qualities and are serviceable up to an extreme age of perhaps 20 years,— in the city horses rarely stand the strain of travel on hard pavements for many years without showing signs of usage sufficient to render them unsalable, except at small prices.

Horses kept for the show-ring and therefore not subject to usage on hard pavements exemplify the fact that there is little or no advantage *per se* in the young horse. Indeed, the horse may be at his best at the age of 10 years, and many of the blue ribbon winners of the past few years are even somewhat older.

The Saddle Horse.— Neglecting the subject of chargers and hunters, the former having but a limited market and being generally subject to army specifications, and the latter constituting too large a subject for discussion in an article of this character, and of more interest abroad, especially in England and Ireland, than in America, we shall say a few words of the saddle horse, presenting as briefly as possible some of the facts which should be borne in mind in supplying the market.

The conformation of the saddle horse will not be found to differ very materially from the carriage horse, and many private owners, who do not feel able or warranted in stabling horses for saddle purposes only, will find a combination horse for saddle and harness use a possibility. A saddle horse is not improved in gait by being harnessed to a vehicle, particularly a heavy one, in fact is impaired thereby, but moderate driving to light vehicles will not incapacitate him wholly for the saddle.

In a «park hack» we should look for somewhat substantial conformation. As in a carriage horse, depth of girth should be sought and the back should be short, all the distance possible, however, separating the forelegs from the hind, the horse having much of his length in his shoulders and quarters. The croup should be long, so that, taken in combination with high and prominent withers and heavy shoulders, the saddle will have a good seat and be prevented from slipping forward. As in the hind legs reside the seat of propelling power the thighs should be long and muscular, and some people prefer the hocks well bent. The pasterns should be somewhat longer and have more spring than in the harness horse.

As in the harness horse, the saddle horse should be about the same width in front as behind. Many will not object, however, to a horse slightly wider behind than in front, as the claim is made that, in a gallop, the hind legs will better pass outside of the forelegs; but, under no conditions should the horse be wider in front than behind. He should have a moderately long and upright neck and a prominent crest, as this is the muscle that supports his head, and the neck should be arched. With this combination a horse will usually carry his head erect without support from the reins, and the rider will have better control and feel that he has something in front of him.

The manners of a saddle horse is an element worthy of particular notice. Besides the qualities and disposition valuable in a harness horse, primarily he must possess a high degree of intelligence and be absolutely fearless; and he needs a further education to make him «bridle wise.» By this term is indicated response to the slightest pressure of the rein on either side of the neck, so that the horse turns readily by the lateral movement of the rein hand. This allows the rider one hand free for use or emergency.

As to gait and action, the horse should have a fast walk, so that when ridden in company he will keep up without breaking into a jog. The trot should be even, springy and regular, so as not to jolt the rider. Extreme action is not a necessary feature, but the horse should possess enough action to be noticeable in company; and high action is not a detriment if unaccompanied by pounding. An easy canter and gallop are necessities, and particularly is this true of the horse intended for long rides or to be used in the country. These gaits should be accomplished with a maximum of forward motion and a minimum of rocking.

Types and sizes of saddle horses vary greatly according to personal taste and the weight to be carried. Some desire a short-legged, thickset cobby horse for weight-carrying, while those of lighter build may prefer a taller horse of less substance and more speed. Above all things the horse should be free and willing, as no man desires, or will tolerate, a horse needing constant urging.

Breeding.—A word or two as to breeding may not be inappropriate, as the requirements of the market are so exacting that every breeder should take them into consideration, in order to produce and raise as large a percentage of marketable horses as possible.

Much has been written upon the subject of horse breeding and genealogy in America, and careful investigation reveals much shallow erudition. The results of recent research have shed sufficient light upon this subject to show that much of the published matter as to the ancestry of the American trotter will not bear close investigation. Heretical as it may seem, the history and origin of the Hambletonian strain of blood, which for years has been held in high esteem among breeders throughout the country, we believe is open to reasonable doubt as to its authenticity. It does not seem unlikely that some of the breeders, in their desire to create a lineage for their horses, drew on their imagination for the breeding of the ancestors. After many years of assumption that the published facts were correct, grave doubt is now cast upon the breeding of some of the original stock. Perhaps, therefore, the less we attempt to demonstrate results by referring to the lineage of the standard bred trotting horse the safer.

Of the other breeds of this country perhaps the best known are the Morgans and Clays, but, generally speaking, such numerous and often careless crosses have been tolerated that these breeds in anything like purity of blood have mostly disappeared. In the author's opinion, up to a recent date, the breeder in America has sought speed to the detriment of action, even going so far as to make conformation a secondary element.

A word should be said about the hackney. Much confusion has resulted temporarily, and probably only temporarily, from the placing on the market of so-called hackneys, which are such only in conformation and not in the action and speed which are characteristic of the hackney of honest blood. This breed lends itself exceedingly well to the requirements of the heavy harness horse when proper individuals are used in the stud. Although at present there are but few such individuals in this country, the hackney dates back in England to the 18th century. It was originally a cross between the shire or English cart horse, an animal somewhat coarse but of much substance, power and action, and the sleeker thoroughbred of delicate conformation and high strung temperament. So well has this breed been cultivated, to the elimination of the coarser individuals by a few reputable breeders in this country, that it is not difficult for the careful judge to discriminate.

Recently, American breeders have achieved extremely satisfactory results by crossing hackney stallions with clean-limbed, nicely turned trotting-bred mares, and while this cross is one that breeders claim should not be carried beyond one generation for fear of the infusion of cold blood in the offspring, a single cross certainly produces a large percentage of good marketable stock. This cross commonly combines high action and much substance with speed and breedy appearance.

As most scientific breeders now acknowledge, the main fact of all breeding is that it is a matter primarily of individuals, good lineage counting for little in the issue if the breeding stock do not themselves fill all the requirements desired. Not only should care be taken to use proper individuals, but if a slight fault exists in either parent — no horse being absolutely perfect — the other should be selected especially proficient in what the one lacks.

Back of the standard bred trotting horse, Morgan, hackney and French coach horse — another imported breed — stand practically the same Arabian ancestors, and as all are to-day bred with one end in view, the choice of one breed as against the others is a matter of selecting the individual best filling requirements.

If the main purpose be to breed for that market which is the most profitable, that of the heavy harness horse, it seems to the author that, instead of horses becoming standard by performance on the track if they became standard by performance in the show-ring all the qualities desired as well as speed would be more properly conserved. Of course, many practical difficulties, some of which would defeat the very ends sought, stand in the way of such a movement unless it were conducted by the government. A stud book formally conducted by the government and authentically recording the lineage and performance of stock, so that the history of a strain and the results of crosses might be generally published and read, would be of immense value to the horse breeder and to the government itself by raising the quality and value of the horses raised both for domestic use and export.

An interesting commentary on the subject of the harness horse and an evolution well worth notice is the gradual elimination of the unreliable small dealer in the metropolis; in fact, the market is fast falling into the hands of the comparatively few reputable dealers who endeavor to conduct their business on broad commercial lines. The purchasing public are beginning to recognize that it is best for their interests to patronize such dealers as can rather afford to take a loss on an unsound or unsafe animal by giving him away than to sell him under a misrepresentation and make a financial gain at the expense of reputation. This fact is not only an assurance that the interest manifested in the horse in our large cities will not decrease, but the business being in good hands that many who have in the past been slow to venture into this field of pleasure and sport can now enter into it as beginners without a long, unsatisfactory and expensive experience as a preliminary. See also HORSE, AMERICAN THOROUGHBRED.

ARTHUR MAN,
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HORSE, Trotting and Pacing. The harness racing horse has two gaits, namely, the trot and the pace. They were both originally the connecting link between the walk and the gallop, but by development and careful training have come to take the place of the latter so far as extreme speed in harness is concerned. The term “diagonal gait” is applied to trotting because the horse employing it raises simultaneously a front and hind foot at opposite sides of the body. In pacing, the front and hind feet on the same side move together, and this is best expressed as the “lateral gait.” No one has yet been able to explain why a horse goes at one or other of these gaits when urged from the walk and guided by the rein to keep from the gallop.

The history of harness racing in America is practically contemporaneous with that of the republic of the United States. After the Revolution the development of speed in the horse had its attractions here as in Europe. At first the running gait was the only one considered, but the importation of an English sire called Messenger marked the beginning of a new era. He was brought over in 1788 and landed at Philadelphia. Though descended from stock that inclined to the gallop and practically a thoroughbred, this horse was more inclined to the trot. What is more remarkable, he transmitted this habit or instinct to so marked a degree that he made a great reputation in the New World through the superiority of his progeny over all other breeds. So “Imported Messenger,” as he was popularly known, was the patriarch of the American trotter, and nearly all of the immense troop of harness racers in this country to-day trace descent to him. His death in 1808 near Oyster Bay, N. Y., was looked upon as a national calamity, and he was buried with military honors, the funeral being attended by prominent horsemen from all the neighboring States. As this horse was the founder of a notable family and represents a type in some respects separate and distinct from others of the *genus equus* it seems unfortunate that no portrait or drawing of him was ever made. There is a pen picture which in some measure atones for this, and is worth quoting. It describes Messenger as of a gray color, standing full 15 hands 3 inches in height, with a thin mane and tail, ears larger than most well-bred horses, but erect and lively.

At the time of Messenger's death the limit of speed at the trot was, in round numbers, a mile in three minutes. The saddle was chiefly in vogue for this gait as well as running, but the employment of a vehicle with two wheels followed the building of better roads. According to J. H. Wallace, an authority on the thoroughbred, a chestnut horse trotted at Philadelphia in a sulky 25 Aug. 1810, one mile in 2:48½ for $600. The horse was 14 years old and barely 15 hands high. There is an earlier feat now accepted as authentic of a horse called Yankee, trotting a mile in 2:59 in 1806 on Harlem Lane, a favorite driving place for New Yorkers. The breeding of these first champions of the sulky remains in obscurity, but it was not long before the descendants of “Imported Messenger” began to do greater things. Topgallant, who is credited with three miles in 8:11 and easily the best trotter of his day, was inbred to Messenger, his sire and dam both being by the potent English stallion. Screwdriver, who went three miles under saddle in 8:02 a year before this, was another of the stars descended from Messenger, as was Dutchman, another long distance trotter, who went his three miles under saddle in 7:32½; but the most famous of the Messenger brood in the nearer generations was Lady Suffolk. She was the first queen of trotters, her reign being a long and undisputed one from 1833 to 1852. She enjoyed the special distinction of being the first trotter to score as fast as 2:30 for a mile in harness. Following Lady Suffolk there were a few lesser lights that improved slightly on her best record, but her real successor as a conqueror of time was Flora Temple. She was foaled in 1845, her turf career beginning in 1852. Five times this wonderful mare reduced the figures that represented the speed limit, her greatest effort being 2:19¾. Then came the mighty Dexter, who reduced the record to 2:17¼. His public career was cut short when Robert Bonner purchased him and took him to New York for his private driving on the road. Goldsmith Maid came out in 1871 and clipped a fraction from Dexter's mark. She was foaled in 1857, made her début at 10 years and continued to fill engagements in races and against time up to 1877. Rarus managed to improve Goldsmith Maid's record a trifle during a very creditable career. The gelding Saint Julien eclipsed him a year after by a full second. Then a new queen appeared in Maud S., and between this fleet pair was a lively duel for the championship. The figures were improved by fractions of a second until the mare reached 2:10¾ in 1880, which proved too much for the gelding. After his surrender another candidate appeared in Jay Eye See. Meantime Maud S. had got down to 2:10¼, but Jay Eye See enjoyed the distinction of being the first to touch the even 2:10. This was in 1884, and then the mare showed that she was the better horse by compassing the track in 2:09¾, and again in 2:08¾.

The greatest mechanical aid to the harness horse that has yet been devised came into use during 1892. This was the application of the ball-bearing axle first applied to the bicycle, with the pneumatic tire and a wheel of about 28 inches diameter. Its first public trial was in a race at Worcester, Mass., early in May, where its manifest advantage enabled a slow horse to fairly play with a field of faster competitors. None of the prominent trainers had seen this new contrivance, and it was not until well along in July that they awoke to a full realization of its merits. The writer was privileged to see and try this sulky with its frictionless gear before it had come into general use, and on exploiting it with a conservative opinion that a horse could go at least two seconds faster than if hitched to the high wheel sulky, was informed by Budd Doble, the leading reinsman of that day, that he was the victim of a hoax. Less than three months after this same Doble had driven Nancy Hanks to one of these smooth running machines a mile in 2:04, or nearly five seconds faster than the record of Maud S. This material reduction was only the beginning of a new era in speed, as other trotters at once took advantage of this appliance and earned the championship in turn. Alix only clipped a quarter of a second from the mark set by Nancy Hanks, but she did this after a hard race campaign that took away from her real ability. It was six years before this resolute overworked mare had to surrender the crown, when in 1900 The Abbot trotted in 2:03¼. He had previously won his spurs in several creditable races, but his successor and conqueror, Cresceus, proved to be a much more remarkable representative of his kind. Starting at three years this Hercules among trotters met and defeated older and more seasoned campaigners in his colthood, scoring 2:11¼ in the eighth heat of a winning race. Then each successive season found Cresceus able to add to his laurels until in 1901 he earned the championship twice. His record of 2:02¼ was followed by the famous match against The Abbot at Brighton track, Brooklyn, N. Y., 15 August, when, in the presence of an immense crowd, many of whom came hundreds of miles to see this battle of the giants, Cresceus was the victor. It was no light task at first, as The Abbot forced him to go in 2:03¼, the fastest mile by nearly two seconds ever scored in a trotting race. Besides these feats Cresceus had lowered many other records, including the one for two miles which he placed at 4:17 late in 1902. During the season of 1903 he again battled against time, and after his previous championship record had been several times beaten by Lou Dillon and Major Delmar this stout warrier trotted in 1:59¾ at Wichita, Kan., in October 1903.

Lou Dillon was first trained in the winter of 1902 on the track at Pleasanton, Cal., and on the death of her breeder and owner was brought to Cleveland and sold at auction. The purchaser, C. K. G. Billings, of Chicago, got a rare bargain at $12,500, and being strictly an amateur he promptly canceled all racing engagements. She then received special training for miles against time, and not only astonished the world by her mile in even time at Boston, but a few days later drew the old-style sulky with high wheels, in 2:05 at Cleveland, clipping three seconds and three-quarters from the record Maud S., made nearly 20 years before. Later on, at Memphis, Lou Dillon added to her fame by another mile in 1:58½ to sulky, and one to wagon in exactly two minutes. She also defeated Major Delmar in a race for the Memphis gold cup; as a six-year-old her best performance was 2:01 at Memphis, 11 Nov. 1904.

Eight years more breeding and training were required before Lou Dillon's mark was passed. Then the wonderful gelding Uhlan appeared and 8 Oct. 1912, at Lexington, Ky., cut the world's trotting record to 1:58, where it stands to-day. It was demonstrated that Uhlan had considerable reserve speed, for after a number of trials, with a running mate, he accomplished a mile in 1:54½, taking three and a half seconds off his own best speed. This astonishing performance took place at Lexington, 9 Oct. 1913, or just a year and a day after he set the world's record. The 1:54½ does not stand as a trotting record, not having been made under the conditions of record racing. The running mate served as an incentive to develop what speed there was in this phenomenal animal.

The fastest mile trotted in a race is that of Hamburg Belle, at North Randall, Ohio, 25 Aug. 1909, 2:01¼. Uhlan holds the record for a half-mile track, made at Goshen, N. Y., 24 Aug. 1911, 2:02¾. The stallion record is held by The Harvester, made at Columbus, Ohio, 22 Sept. 1910, 2:01. The yearling record is held by Airdale, made at Lexington, Ky., 2 Oct. 1912, 2:15¾. Peter Volo took the two, three and four-year-old records in 1913, 1914 and 1915, the figures being 2:04½, 2:03½ and 2:02. The best two-mile heats recorded stand to the credit of Hamburg Belle, 25 Aug. 1909, 2:01¼ and 2:01¾. The Harvester holds the two-mile trotting record, made at Lexington, Ky., 13 Oct. 1910, 4:15¼. In trotting to wagon against time, Lou Dillon, at Memphis, Tenn., 28 Oct. 1903, made a mile in 2:00, but she was paced by a runner carrying a wind shield. Uhlan trotted a mile to wagon with no shield or artificial aid, at Cleveland, Ohio, 8 Aug. 1911, in the same time, 2:00. At Lexington, Ky., 11 Oct. 1912, Uhlan and Lewis Forest trotted as a team in 2:03¼.

The following table gives the names of all the record makers among the trotters and shows how the figures have been reduced from 2:30 to 1:58:

Lady Suffolk, gr. m. foaled 1833, by Engineer 2d; dam by Don Quixote. Driven by David Bryan, Beacon Course, Hoboken, N. J., 13 Oct. 1845, 2:29½.

Pelham, b. g. foaled 1837, pedigree not traced. Driven by William Whelan, Centreville, N. Y., 2 July 1849, 2:28.

Highland Maid, b. m. foaled 1847, by Saltram; dam Roxanna, by Hickory. Driven by F. J. Nodine, Centreville, N. Y., 15 June 1853, 2:27.

Tacony, ro. g. foaled 1844, by Sportsman; dam not traced. Union Course, N. Y., 14 July 1853, 2:27.

Flora Temple, b. m. foaled 1845, by Bogus Hunter; dam Madam Temple, by Terry Horse. Driven by Hiram Woodruff, Union Course, East New York, N. Y., 2 Sept. 1856, 2:24½.

Flora Temple. Driven by James D. McMann, Centreville, N. Y., 9 Aug. 1859, 2:23½.

Flora Temple. Driven by James D. McMann, Centreville, N. Y., 9 Aug. 1859, 2:22.

Flora Temple. Driven by James D. McMann, Cincinnati, Ohio, 7 Oct. 1859, 2:21½.

Flora Temple. Driven by James D. McMann, Kalamazoo, Mich., 15 Oct. 1859, 2:19¾.

Dexter, br. g. foaled 1858, by Hambletonian; dam Clara, by American Star. Driven by Budd Doble, Riverside Park, Boston, Mass., 30 July 1867, 2:19.

Dexter. Driven by Budd Doble, Buffalo, N. Y., 14 Aug. 1867, 2:17¼.

Goldsmith Maid, b. m. foaled 1857, by Alexander's Abdallah; dam Ab. by Abdallah. Driven by Budd Doble, Milwaukee, Wis., 6 Sept. 1871, 2:17.

Goldsmith Maid. Driven by William H. Doble, Mystic Park, Boston, Mass., 9 June 1872, 2:16¾.

Occident, br. g. foaled 1863, by Doc; dam Mater Occidentis, pedigree not traced. Driven by George Tennet, Sacramento, Cal., 17 Sept. 1873, 2:16¾.

Goldsmith Maid. Driven by Budd Doble, East Saginaw, Mich., 16 July 1874, 2:16.

Goldsmith Maid. Driven by Budd Doble, Buffalo, N. Y., 7 Aug. 1874, 2:15½.

Goldsmith Maid. Driven by Budd Doble, Rochester, N. Y., 12 Aug. 1874, 2:14¾.

Goldsmith Maid. Driven by Budd Doble, Mystic Park, Boston, Mass., 2 Sept. 1874, 2:14.

Rarus, b. g. foaled 1867, by Conklin's Abdallah; dam Nancy Awful, by Telegraph. Driven by John Splan, Buffalo, N. Y., 3 Aug. 1878, 2:13¼.

St. Julien, b. g. foaled 1869, by Volunteer; dam Flora, by Harry Clay. Driven by Orrin Hickok, Oakland, Cal., 25 Oct. 1879, 2:12¾.

Maud S., ch. m. foaled 1874, by Harold; dam Miss Russell, by Pilot Jr. Driven by W. W. Bair, Rochester, N. Y., 12 Aug. 1880, 2:11¾.

St. Julien. Driven by Orrin Hickok, Rochester, N. Y., 12 Aug. 1880, 2:11¼.

St. Julien. Driven by Orrin Hickok, Hartford, Conn., 27 Aug. 1880, 2:11¼.

Maud S. Driven by W. W. Bair, Chicago Driving Park, Chicago, Ill., 18 Sept. 1880, 2:10¾.

Maud S. Driven by W. W. Bair, Homewood Park, Pittsburgh, Pa., 13 July 1881, 2:10¼.

Maud S. Driven by W. W. Bair, Rochester, N. Y., 11 Aug. 1881, 2:10¼.

Jay Eye See, bl. g. foaled 1878, by Dictator; dam Midnight, by Pilot Jr. Driven by Edwin Bither, Providence, R. I., 1 Aug. 1884, 2:10.

Maud S. Driven by W. W. Bair, Cleveland, Ohio, 2 Aug. 1884, 2:09¾.

Maud S. Driven by W. W. Bair, Lexington, Ky., 11 Nov. 1884, 2:09¼.

Maud S. Driven by W. W. Bair, Cleveland, Ohio, 30 July 1885, 2:08¾.

Sunol b. m. foaled 1886, by Electioneer; dam Waxana, by Gen. Benton. Driven by Charles Marvin, Stockton, Cal., 20 Oct. 1891, 2:08¼.

*Nancy Hanks, br. m. foaled 1886, by Happy Medium; dam Nancy Lee, by Dictator. Driven by Budd Doble, Chicago, Ill., 17 Aug. 1892, 2:07¼.

Nancy Hanks. Driven by Budd Doble, Independence, Iowa, 31 Aug. 1892, 2:05¼.

Nancy Hanks. Driven by Budd Doble, Terre Haute, Ind., 28 Sept. 1892, 2:04.

Alix, b. m. foaled 1888, by Patronage; dam Atlanta, by Attorney. Driven by Andy McDowell, Galesburg, Ill., 19 Sept. 1894, 2:03¾.

The Abbot, b. g. foaled 1893, by Chimes; dam Nettie King, by Mambrino King. Driven by Ed. Geers, Terre Haute, Ind., 25 Sept. 1900, 2:03¼.

Cresceus, ch. h. foaled 1894, by Robert McGregor; dam Mabel, by Mambrino Howard. Driven by George H. Ketchum, Cleveland, Ohio, 26 July 1901, 2:02¾.

Cresceus. Driven by George H. Ketchum, Columbus, Ohio, 2 Aug. 1901, 2:02¼.

Lou Dillon, ch. m. foaled 1898, by Sidney Dillon; dam Lou Milton, by Milton Medium. Driven by Millard F. Sanders, Readville, Mass., 24 Aug. 1903, 2:00.

Lou Dillon. Driven by M. F. Sanders to high wheel sulky, Cleveland, Ohio, 12 Sept. 1903, 2:05.

Cresceus. Driven by George H. Ketchum, Wichita, Kan., 19 Oct. 1903, 1:59¾.

Lou Dillon. Driven by M. F. Sanders, Memphis, Tenn., 24 Oct. 1905, 1:58½.

Uhlan. At Lexington, Ky., 8 Oct. 1912, 1:58. The following year Uhlan made a mile with running mate in 1:54½, but this does not stand as a record.

The progress and development of the lateral or pacing gait has kept side by side with trotting. Before Lady Suffolk had opened the door for the 2:30 list, the pacer Dover had gone a mile in 2:28. Dividing the century, since speed in harness for a mile was first considered, into two decades we are able to compare the two gaits and note the progress of each by the following table. The names of pacers are in italics:

1800–1810

Yankee, b. g.	Harlem, N. Y.	2:59

1810–1820

Boston Horse, ch. g.	Philadelphia, Pa.	2:48½
Bolton Blue, bl. g.	Jamaica, N. Y.	3:00

1820–1830

Topgallant, b. g.	1829—3 miles	8:11
Bowery Boy	1829—2 miles	5:04½

1830–1840

Edwin Forrest, bl. g. (to saddle)	1834	2:31½
Sally Miller, b. m.	1834	2:37
Drover, b. g.	1839	2:28

1840–1850

Lady Suffolk, gr. m.	1845	2:29½
Moscow, b. g.	1845	2:30
Pelham, b. g.	1849	2:28
James K. Polk, ch. g.	1845	2:27

1850–1860

Flora Temple, b. m.	1859	2:19¾
George M. Patchen, b. h.	1859	2:26½
Ethan Allen, b. h.	1858	2:28
Pocahontas, ch. m.	1855	2:17¼
Pet, ro. g.	1852	2:18½

1860–1870

Dexter, br. g.	1867	2:17¼
Goldsmith Maid, b. m.	1869	2:19¾
George Wilkes, br. h.	1868	2:22
George M. Patchen, b. h.	1860	2:23½
Ethan Allen, b. h.	1860	2:25½
Billy Boyce, b. g. (to saddle)	1868	2:14½

1870–1880

St. Julien, b. g.	1879	2:12¾
Rarus, b. g.	1878	2:13¼
Goldsmith Maid, b. m.	1874	2:14
Smuggler, br. h.	1876	2:15¼
Sleepy Tom, ch. g.	1879	2:12¼
Rowdy Boy, bl. g.	1879	2:13¾

1880–1890

Maud S., ch. m.	1885	2:08¾
Jay Eye See, bl. g.	1884	2:10
St. Julien, b. g.	1880	2:11¼
Axtell (3 yrs.), b. h.	1889	2:12
Malxie Cobb, b. h.	1884	2:13¼
Phalas, b. h.	1884	2:13¾
Johnston, b. g.	1884	2:06¼
Gold Leaf (4 yrs.), ch. m.	1889	2:11¼
Little Brown Jug, b. g.	1881	2:11¾
Brown Hal, br. h.	1889	2:12½

1890–1915

Uhlan, g.	1912	1:58
Lou Dillon, ch. m.	1903	1:58½
Cresceus, ch. h.	1903	1:59¾
Major Delmar, b. g.	1903	2:00½
The Harvester, s.	1910	2:01
Hamburg Belle, m.	1909	2:01¼
Cresceus, ch. h.	1901	2:02¼
The Abbot, b. g.	1900	2 03¼
Alix, b. m.	1894	2:03¾
Nancy Hanks, br. m.	1892	2:04
Azote, b. g.	1895	2:04¾
Directum, bl. h.	1893	2:05¼
Stamboul, br. h.	1892	2:07½
Arion, b. h.	1893	2:07¾
Kremlin, b. h.	1892	2:07¾
Martha Wilkes, b. m.	1892	2:08
*Lou Dillon	1903	2:05
*Sunol, b. m.	1891	2:08¼
*Palo Alto, b. h.	1891	2:08¾
*Direct	1891	2:06
Dan Patch, br. h.	1906	1:55¼
Directum I	1915	1:56¾
Prince Alert	1903	1:57
Star Pointer, b. h.	1897	1:59¼
John R. Gentry, b. h.	1896	2:00½
Prince Alert, b. g.	1902	2:00
Dariel, m.	1903	2:00¼
Joe Patchen, bl. h.	1897	2:01¼
Robert J., b. g.	1894	2:01½
Mascot, b. g.	1892	2:04
Hal Pointer, b. g.	1892	2:04½
Direct, bl. h.	1892	2:05½

The stallion Dan Patch remains the king of pacers, his half-mile made at Memphis, Tenn., 27 Oct. 1903, and his mile made at Saint Paul, 8 Sept. 1906, in 1:55¼, being unequaled. The greatest pacers in 1915 are William, who as a four-year-old, at Grand Rapids, Mich., 5 Aug. 1914, made a mile in 2:00, and at Cleveland, Ohio, 16 Aug. 1915, beat Directum I in 1:58½, and Directum I, who a month after losing to William made 1:56¾ at Syracuse, N. Y., this being the stallion record for pacers. In 1918 Miss Harris did a mile in 1:58¼.

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* First champion mile to bicycle sulky.

* Made to high wheel sulky.

In the matter of breeding, reference has already been made to the fact that the imported horse Messenger, who played so important a part in the generation of harness horses, was of running stock. His descendants that have influenced this type more than any others were Rysdyck's Hambletonian and Mambrino Chief. The former was the son of Abdallah, whose sire Mambrino was by the English Messenger. This same Mambrino was also the grandsire of Mambrino Chief, so that his blood more than that of any of the get of Messenger has been potent in the production of the numerous fast exponents of the two harness gaits. Bellfounder, another English horse, brought over to Boston in 1823, had also much to do in founding the American trotter. His origin seems to be obscure, but he was probably of the type known as the Norfolk roadster, from which the hackney has sprung. The most famous of his progeny in the first generation was the Charles Kent mare, the dam of Rysdyck's Hambletonian. At least 75 per cent of what are called "Standard bred" trotters trace to this sire, and as none of the rest of Abdallah's get amounted to much there is every reason to believe that this daughter of imported Bellfounder had the inherent quality which made the Hambletonian strain so valuable. Every one of the champion trotters that succeeded Flora Temple are descended directly from this horse, Dexter himself being one of his sons.

The records of the running horses will be found under HORSE-RACING.

HORSE ANT, a hymenopterous insect of the family *Mutillidæ*. Other common names for the insect are cow ants, cow-killer ants and velvet ants. Structurally, they are similar to the true ants. The males have wings and hairy bodies. The females are wingless, unsocial in their habits and they also sting. They are found frequently in the early stages of their development as parasites in wild bee nests. In New England, certain ants of the genus *Camponotus* are also called horse ants.

HORSE IN ART AND SYMBOLISM. In Christian art the horse has been considered as a symbol of courage, intrepidity and generosity. In an opposite sense this animal has been used as an emblem of luxury. The Bible and the Fathers treat of the horse as emblematic of both virtue and vice, as all animals have in their nature both good and bad qualifications. Depictions of a horse found in the Catacombs are symbolic of the fleetness of life's course, and the palm wreath sometimes pictured above the horse's head is declared to convey the idea that the palm of victory is not always to the swift. Fairholt tells us that the horse in ecclesiastical art is an attribute of Saint Martin, Saint Maurice, Saint George and Saint Victor, who are represented on horseback; as also is Saint Leon in pontifical robes, blessing the people. Husenbeth informs us that Saint Severus and Saint Quirinus have been depicted with a horse by their side; Saint Elegius (or Eloy), the patron saint of the goldsmiths, has been represented with a horse's leg in his hand, the hoof shod and a hammer in the other hand; this scene is taken from the legend of the saint lifting off, in miraculous manner, the horse's leg and shoeing the hoof, then replacing the leg, when the animal was brought to him as being too unmanageable for any farrier to handle. In Chinese symbolism the horse is an emblem of wisdom. Ancient art gives us many forms of horse monsters. The hippocamelus was a fabulous creature, half camel, half horse. The hippocampus of the Greeks and Latins was a monster with head and forequarters of a horse to which the tail of a dolphin or some other fish was attached; Pompeii mural decoration displays this creature in paintings as hauling Neptune's marine chariot. The hippocentaur was a fabulous creation with a horse's body and head and bust of a human being, male or female. This hippocentaur, or centaur, is often found armed with bow and arrow, in which case it is termed sagittarius or sagittary. In this form it is the ninth sign in the celestial zodiac and represents August in the constellations. The hippocervus was half horse and half stag. We are told that the hippocervus is a Christian symbol of the pusillanimous man "who throws himself without reflection into uncertain paths and soon falls into despair at having lost himself in them." The hippogryph (or hippogriff) is a fabulous monster depicted as the body of a horse with wings and the head of a griffin; or sometimes it is found with the claws of a lion, some even have a lion's tail. The Greco-Roman artists gave free fancy to this creation as we find them on the wall decorations of Pompeii. The hippogryph is said to have been a symbol of love. The Greeks also had a hippolectryon which was a hybrid composition of horse and cock. In ornament and composition of the rinceaux of friezes is the hippopod, a monster in form of a man with horses' legs.

CLEMENT W. COUMBE.

HORSE BOT-FLY, a bot-fly (*Gastrophilus equi*) parasitic in horses. The adult is about .75 inch long; the wings transparent with dark spots forming an irregular band toward the centre; the body brown and very hairy, the head whitish in front, and the abdomen dark-spotted. The females (males are rarely seen) have an elongated tapering abdomen. The oblong light, yellow eggs are glued, one by one, to the hairs of the forepart of the body, where they are likely to be licked off by the animal. The moisture of the tongue causes the developed larvæ to break through the shell almost instantly, and to be carried into the mouth and thence to the stomach. Many curious facts have been observed in connection with these eggs and their development and may be found fully discussed by Osborn in his 'Insects Affecting Domestic Animals,' issued by the United States Department of Agriculture (1896). Reaching the stomach, the larvæ fasten themselves to its walls by hooks in the posterior end of the body, and great masses sometimes accumulate seriously obstructing the pyloric outlet. They remain there, absorbing nourishment and interfering with digestion through the winter, and on the return of warm weather let go their hold, pass out through the intestines, enter the ground, pupate there for a few days, and then emerge as flies. This pest chiefly affects horses out at pasture, and can be prevented only by removing the eggs, which can easily be seen. The attempt to remove the bots from the stomach by turpentine or other drugs is a dangerous proceeding which should only be attempted under direction of a veterinarian.

HORSE-CHESTNUT, or BUCKEYE, a tree of the small family *Aesculaceæ* and genus *Aesculus*, represented in Europe by the horse-chestnut (*A. hippocastanum*), now cultivated in many parts of the world, but native to Greece, Turkey and southwestern Asia; and by several indigenous American species known as buckeyes, from the appearance of the fruit. These trees are shapely, have five or more leaflets diverging from the stalk like fingers, and bear white or tinted flowers in large erect panicles, turning the whole tree into the semblance of a big bouquet. The fruit of the horse-chestnut much resembles a huge chestnut, and is prickly when young. In this respect the common or Ohio buckeye (*A. glabra*) agrees with it, but has only five leaflets in each leaf and its flowers are small and not showy. The unpleasant odor exhaled by the bark and leaves in all this genus is especially strong in this species. A more southern species, developed into fine trees in the southern Alleghanies, is the sweet or yellow buckeye (*A. octandra*) which with the red buckeye (*A. pavia*) bears smooth fruit. Though so handsome, rapid in growth, and serviceable as ornamental or shade trees, they are otherwise of little value. The wood is light colored, soft and useful mainly for paper pulp and small articles; it contains a large quantity of saponaceous material, so that country people use the mucilaginous sap as soap. The leaves and roots of the Ohio buckeye are poisonous. The seeds are bitter but are eaten by cattle and sheep, with the preparation of boiling in alkaline water which is necessary in Europe; and from them a flour is made especially adapted to bookbinders and shoemakers' paste, as besides having great tenacity. it will not be attacked by insects. In France starch is produced from horse-chestnut seeds on a large scale. The seeds are also used in the southern United States to impart a flavor of age to raw whisky. The red buckeye has been naturalized in Europe as a park tree. California has a species of its own, Japan another and a third grows on the Himalaya Mountains.

HORSE-FLY, GAD-FLY, or DEER-FLY, any species of the family *Tabanidæ*, usually large, robust flies, with a broad head pointed in front and concave behind, with proportionally immense eyes, and fitting closely to the thorax. The legs are long and stout; sometimes hairy, but without stiff bristles. The females are provided with a long, sharp proboscis with which they pierce the skin of animals, and are especially annoying to such short-haired kinds as horses and deer. No poison is injected into the wound, but injurious bacilli may be introduced, causing bad sores. One of the most widely distributed in the United States is the large black *Tabanus americanus*. These flies attach their eggs to grass and sticks in wet places. The larvæ find their way into water or wet earth, and are carnivorous, feeding on other insects, snails, etc. They pass the winter before pupating and emerge as flies in the early summer. To the same family belong many smaller green or yellow species of the woods, more usually called deer-flies.

HORSE-MACKEREL. The horse-mackerel tuna or tunny (*Thunnus thynnus*), is the largest member of the mackerel family (*Scombridæ*), attaining a length of 10 feet or more and a weight of 1,000 to 1,500 pounds. It is found in all warm seas, both of the Atlantic and Pacific oceans, and wanders as far north as Newfoundland, appearing on our shores with the menhaden and mackerel. See TUNNY.

HORSE POWER, the power of an ordinary horse or its equivalent, the force with which a horse acts when drawing. The mode of ascertaining a horse's power is to find what weight he can raise and to what height in a given time, the horse being supposed to pull horizontally. From a variety of experiments it is found that a horse, at an average, can raise 160 pounds weight at a volocity of two and a half miles per hour. The power of a horse exerted in this way is made the standard for estimating the power of a steam-engine or other motor. Thus we speak of an engine of 60 or 80 horse power, each horse power being estimated as equivalent to 33,000 pounds raised one foot high per minute, but this estimate is considered much too high, 17,400 foot-pounds per minute being generally considered nearer the truth. As it matters little, however, what standard be assumed, provided it be uniformly used, that of Watt has been generally adopted. In estimating horse power, it is important to remember the element of time; the shorter the time the greater the power exerted. The general rule for estimating the power of an engine or motor in terms of this unit is to multiply together the pressure in pounds on a square inch of the piston, the area of the piston in inches, the length of the stroke in feet and the number of strokes per minute; the result divided by 33,000 will give the horse power deducting one-tenth for friction. As a horse can exert its full force only for about six hours a day, one-horse power of machinery may be said to equal that of four horses. The difference between an animal and a machine is further illustrated by the fact that any robust man can for a short time put forth more energy than this theoretical horse power; but he cannot maintain it, while the engine can, as long as it is in order and the power is applied. See ENGINEERING TERMS; INTERNAL COMBUSTION ENGINE.

HORSE-RACING, a national pastime, which has been called the sport of kings because it has been one of their amusements since the earliest dawn of civilization. The racing horse is of three distinct types, the running horse, the pacing horse and the trotting horse. For many centuries the running race has been the traditional turf sport in Great Britain and on the Continent, with many varieties, such as flat racing, or racing on level ground; steeplechasing, or racing over ground not specially prepared for the purpose, and hurdle-racing, in which the horses have to leap over obstacles purposely placed in the way. Trotting is primarily an American institution, the outcome of thoroughbred development. Late in the 19th century horse-racing made a wonderful advance in the United States and easily became the great national pastime of the country.

Early History.— Thothmes I, of the 18th Egyptian dynasty. left a papyrus letter telling of his conquest of Mesopotamia, and priding himself upon the acquisition of the racing horse (the Arab) and being the first to introduce him in Africa. Somewhat later the records tell of King Solomon buying horses from Egypt, and paying as much as $3,000 for some of them. Among the Greeks it was introduced into the Olympic games in the 33d Olympiad (648 B.C.). From Greece it was introduced into Rome, where it gained a place as one of the games of the circus. The institution of horse-races in England, where the sport has become a great national pastime, belongs to a very remote period. The first regular horse-races, however, did not take place till the reign of James I. The successors of James I down to Queen Anne were all more or less attached to the sport. In the reign of the latter, in 1711, the York Plates were founded, and about that date the passion for betting on the turf began to be general. Under George I, the successor of Queen Anne, horse-racing became more flourishing. The two most celebrated horses of that period were Flying Childers (foaled in 1715) and Eclipse (foaled in 1764), which long had the reputation of being the fleetest horses that ever ran. From the latter are descended many of the first-class thoroughbreds of the present day. None of the English sovereigns was more devoted to horse-racing than George IV. Between 1784 and 1792, while yet Prince of Wales, he gained 185 prizes, including the Derby of 1788. Horse-racing was introduced into France from England during the reign of Louis XIV, and under Louis XV was pursued with the utmost enthusiasm.

Breeding and Training.— The training of a running horse begins with its second year, and is a slow process, requiring great care and attention. During the period of training the horse is under the charge of a stable-boy. In the first part of the training the exercise to which the horse is subjected is comparatively gentle, but in the latter part a gallop of half or three-quarters of a mile is taken every other day. Before a race takes place the powers of the horse are put to the test by its being made to run over about half a mile against an older horse, which is weighted to make up for the difference in age. The breeding of thoroughbred horses, that is, of horses which can trace an unbroken pedigree through the best sires and the best dams, is when well conducted a very profitable business. The prices given for stallions are sometimes enormous. In 1900, when the Duke of Westminster's racing stud was sold, the average price reached the high level, and the world's record price of $187,500 was brought by Flying Fox, which had won the Derby the year before. Before this, Ormonde, another Derby winner, had sold for $150,000. The large sums now given for the use of stallions in breeding studs are the cause of race-horses being withdrawn much earlier than formerly from the turf, for as soon as they have acquired a reputation the owner of a good race-horse can make much larger sums by hiring it out for breeding purposes than he could by entering it for races. The pedigrees of all thoroughbred horses are registered in the stud-book, so that if any particular animal is omitted in that register the inference is that its pedigree is not without some blemish more or less remote. The effects of a careful system of breeding in improving the quality of horses are very marked. No pure Arabian horse can be compared in point of speed with a thoroughbred. In size and shape, too, the horses of the present day surpass those of former times, the average height of a thoroughbred now being 15 hands 3 inches, while formerly it seldom reached 15 hands. See also HORSES, AMERICAN THOROUGHBRED.

Race Meetings.— In Great Britain the chief race meetings are those of Epsom, Newmarket, Ascot in Berkshire, Doncaster, Goodwood, Liverpool, Manchester and Leicester. Those at Newmarket are the oldest of all, dating from the reign of Charles II. The Ascot races are considered the most fashionable, being largely attended by the aristocracy, and sometimes honored with the presence of royalty. The Goodwood races, which are held in the Duke of Richmond's park in Sussex, are also a favorite rendezvous of the aristocracy. But the most popular meeting throughout the year is the Epsom, which owes its popularity partly to the proximity of Epsom to London and partly also to its being the meeting at which the Derby and the Oaks are run. At the Oaks the ladies are the chief bettors, and the bets are not thousands of pounds, but dozens of Paris gloves. The principal racing meetings in France are those held in spring and autumn at Chantilly and the Bois de Boulogne.

In the United States the season opens at the Bennings track at Washington early in the spring and closes there in the fall. Following Bennings comes the Aqueduct, and Morris Park, Gravesend and Sheepshead, the latter track being the show track of this country, occupying the same position as the Ascot of the English turf, which is also named "The Ladies' Meet." Then follows the Brighton Beach season during July and August. The classic events of England and France are of longer standing but cannot be said to outrank or outinterest the famous Brooklyn Handicap, founded in 1887; the Suburban (1884); or the Futurity (1888); although laws against betting have seriously reduced public attendance at tracks in New York. There are racing parks and tracks in nearly every city in the country, and there are many famous meetings in the West and South, like the Latonia in Kentucky, the Harlem and Washington Park in Chicago, Saratoga and others.

Racing Rules.— The conditions under which the most of the races are run are the following: Every horse that takes part in a running race must be entered as a yearling, that is, before the close of the year in which it is foaled, for a horse's age is always reckoned from the first of January of the year in which its birth takes place. On being entered a certain sum is paid by the owner, which is called a forfeit, because it is forfeited if the horse is afterward withdrawn, or in the language of the turf, "scratched." The racing is conducted under association rules, and in England under regulations laid down by the Jockey Club, a body instituted in 1750. The stewards of the Jockey Club have power to grant and to withdraw licenses to racing officials, jockeys and race-courses; to fix the dates on which all meetings shall be held, and to make inquiry into and deal with all matters relating to racing. At every regular race-meeting there must be at least two stewards, with a clerk of course, a handicapper, a stake-holder, a clerk of the scales (since the jockeys of course must be carefully weighed), a starter and a judge, each of these officials being licensed by the club.

Handicapping.— Formerly all running races were what is called weight-for-age races, that is, all the horses entered to compete were of the same age and bore equal weights, or if in certain cases there was an inequality in point of age there was also a fixed difference in the weight carried. But it was found that when races were conducted on this plan the best horses came to be known, and the inferior ones withdrew, not venturing to compete with them, so that the race resulted in a walk-over. Hence arose the practice of handicapping, that is, of adjusting as nearly as possible the weight to be carried to the previously ascertained powers of the horse, so as to reduce the chances of all the horses entered to an exact equality. In England the principal weight-for-age race for two-year-olds is the Middle Park Plate, and for the three-year-olds the principal for both colts and fillies are the Two Thousand Guineas, the Derby and Saint Leger, and for fillies only the One Thousand Guineas and Oaks. The most important handicap races are the Great Northampton Stakes, the City and Suburban and Metropolitan Stakes at Epsom, the Northumberland Plate, the Goodwood Stakes, the Ascot Stakes, the Ebor Handicap (run at York), the Great Yorkshire Stakes (run at Doncaster), the Liverpool Spring, Summer and Autumn Cups, the Cesarewitch, Cambridgeshire and Newmarket Handicaps (run at Newmarket).

Betting and Book-making.— The prevalence of the practice of betting in connection with horse-racing is a fact so well known that it is needless to enlarge upon it, although it will be of interest to some to explain in what manner it is conducted. Bettors are divided into two classes — the backers of horses and the bookmakers, or professional bettors, who form the betting ring, and make a living by betting against horses according to a methodical plan. Backers of horses may be again divided into those who have special information about the qualities of the horses which are to engage in a race, which enables them to back a particular horse with a certain amount of confidence; and those who have no such means of information, and accordingly back horses pretty much at random. The former class, if their information is good, have a very fair chance of success in their speculations and the horse that wins any great race usually brings in to his owner vast sums in payment of bets, compared with which the stakes, considerable as they often are, are insignificant; but the latter class are pretty certain in the long run to lose. By the method adopted by the professional bettor the element of chance is as far as possible removed. Instead of backing any particular horse, the professional bettor lays the same sum against every horse that takes the field, or a certain number of them, and in doing so he has usually to give odds, which are greater or less according to the estimate formed of the chance of success which each of the horses has on which the odds are given. In this way while in the event of the race being won (as is usually the case) by any of the horses entered in the betting-book of a professional bettor, the latter has always a certain fixed sum (say $5,000) to pay, he receives from the backers of the losers sums which vary in proportion to the odds given. Thus, if a bookmaker is making a $5,000 book and the odds against some horse is 4 to 1, he will, if that horse wins, have to pay $5,000, while, if it loses, he will receive $1,250. If the sum of the amounts to which the horses in a particular race have been backed in some professional bettor's book is $6,500, and if the odds against the first favorite were 5 to 2 (or $5,000 to $2,000), then the total sum received by the bookmaker, in the event of the race being gained by the first favorite, would amount to $6,500, $2,000 or $4,500, so that he would suffer a loss of $500; while if a horse had won that had long odds against him (say 200 to 1, or $5,000 to $25), his total receipts would amount to $6,475 and his gains to $1,475. Very frequently the receipts of the bookmaker are augmented by sums paid on account of horses which have been backed and never run at all.

Americans Abroad.— In 1855 an American horse had never won a race abroad and an American jockey had never ridden in an English race. The first American to go to England with a stable of thoroughbreds was Richard Ten Broeck, who sailed for England in 1856, taking with him Lexington, Lecompte, the only horse that ever beat Lexington; Pryor and Prioress. Lecompte died of influenza the first year, and Pryor soon followed. It was left for Prioress to retrieve the fortunes of the stable. Her great victory was in the Cesarewitch, a race at two miles, two furlongs and 28 yards. There were 37 starters, the very best horses on the English turf. After one of the most exciting races ever run, Prioress, El Hakim and Queen Bess finished in a dead heat. In the run off, the American horse won by a length in four minutes and 15 seconds. American successes really began in 1878, when Pierre Lorillard and James R. Keene shipped stables to England. The former's Parole won the Newmarket Handicap, defeating the English favorite, Isonomy, a horse that was called the best ever foaled on English soil. The American gelding next took the great Metropolitan, the great Cheshire and the Epsom Gold Cup in quick succession. Iroquois followed Parole, winning four important stakes in 1880, including the Saint Léger. The subsequent invasion of England by W. C. Whitney, Clarence A. Mackay, Richard Croker and others with famous winning horses, and the successes of Sloan, Reiff, Martin and other American jockeys, have brought renown to the American turf. In 1902, American horses ridden by American jockeys took part in 561 races in England, of which they won 85, were second in 80, third in 52 and unplaced 344 times. The stakes and purses won amounted to $234,120. Since 1903, the Americans have done even better, proportionately, almost every year and their winnings have exceeded $1,000,000. American horses were second in the Oaks and third in the Derby. In 1907, the Derby was won by a horse owned by an American.

Trotting.—The evolution of the trotting horse in America, and the gradual reducing of the one mile record, is a history coincident with the improvement and progress made in breeding. Beginning with the record of Trouble, who trotted a mile in 2.43 in 1826, of Dutchman (2.32) in 1839 and Flora Temple (2.19¾) in 1859, the evolution proceeds to George Wilkes, Dexter, Goldsmith Maid and the others who followed. In 1818, at a Jockey Club dinner, discussion drifted to the trotter, and a wager was made that no horse could be produced which could trot a mile in three minutes. Boston Blue was named at the post by Maj. William Jones, and the old chronicle says that he "won cleverly and gained great renown." The New York Trotting Club was organized in 1825, for the purpose of improving the speed of road-horses. The initial purses were for races of two-mile and three-mile heats. In 1835 trotting was in almost daily vogue in New York. It was not until 1845 that a mile was trotted in less than 2.30. In 1863, the American trotting horse was an unknown quantity abroad, while since 1903, American trotting stock has been in demand in Europe. Germans, French, Russians and Austrians have bought some of our best bred animals.

The National Trotting Association was formed in 1870 as a result of a meeting of breeders and track owners the previous year. In 1887 the American Trotting Association was formed with headquarters in Chicago, and it works with the National Trotting Association to detect and punish fraud. Some of the ablest men in the country sit on the boards of appeals, and the decisions command respect and are accepted as final. The careers and records of famous trotters like George Wilkes; Dexter; Harrietta; Axtell (2.12); Saint Julien (2.11¼); Sunol (2.10½); Maud S. (2.08¾); Kremlin (2.07¾); Stamboul (2.07½); Beuzetta (2.06¾); Directum (2.05½); Nancy Hanks (2.04); Alix (2.03¾); The Abbot (2.03¼), and the mile of Major Delmar and of Hamburg Belle (2.00¼); Cresceus (1.59¾); Lou Dillon (1.58½) and Uhlan (1.58), tell the story of the trotting horse in America. See also HORSES, TROTTING AND PACING.

Prominent owners of racing stables in the United States are H. P. Whitney, J. L. Holland, H. G. Bedwell and J. O. Talbott. The best performances on the American running turf are quarter mile, Bob Wade, 4 years, at Butte, 1890, .21¼; three-eighths mile, Atoka, 103 pounds, Butte, 1906, .33½; half mile, Geraldine, 4 years, 122 pounds, Morris Park, 1889, .46; five-eighths mile, Maid Marian, 4 years, 111 pounds, Morris Park, 1894, .56¾; six furlongs (Futurity), Kingston, 139 pounds, Sheepshead Bay, 1891, 1.08; Artful, 2 years, 130 pounds, Morris Park, 1904, 1.08; seven furlongs, Roseben, 5 years, 126 pounds, Belmont Park, 1906, 1.22; one mile, Salvator, 4 years, 110 pounds, against time, Monmouth Park, 1890, 1.35½; Stromboli, 3 years, 117 pounds, Belmont Park, 1914, 1.36 3/5; one and a quarter miles, Whisk Broom II, 6 years, 139 pounds, Belmont Park, 1913, 2.00; one and a half miles, Goodrich, 3 years, 102 pounds, Washington Park, Chicago, 1898, 2.30½; two miles, Everett, 4 years, 107 pounds, Pimlico, Md., 1910, 3.25 3/5. The largest purse won in regular American events was the Futurity of 1904, $42,880, first place, won by Artful, six furlongs, in 1.11 4/5. The highest purse in the Brighton Handicap is $21,750, which was offered in both 1904 and 1905, being won by Broomstick and Artful respectively. The Brooklyn Handicap's largest purse was $19,750, in 1908, when J. R. Keene's Celt won. The Suburban Handicap paid $19,750 to the winners of 1908, when Keene's Ballot won. The Metropolitan Handicap's largest purse was $10,850, in 1906, Grapple being first. The Futurity is now the only race around New York where a large purse is given annually.

The English Derby, which has been run since 1788, over a course of about a mile and a half, shows the following records in recent years:

Year	Owner and winner	Time	Second
1905	Lord Rosebery's Cicero..	2.39 3-5	Jardy.
1906	Maj. Loeder's Spearmint.	2.36 4-5	Pictou.
1907	Richard Croker's Orby...	2.44	Slieve Gallion.
1908	E. Ginistrelli's Signorinetta..................	2.39 4-5	Primer.
1909	King Edward's Minoru..	2.42 2-5	Louviers.
1910	Mr. Fairie's Lemberg....	2.35 1-5	Greenback.
1911	J. B. Joel's Sunstar.....	2.36 4-5	Stedfast.
1912	W. Raphael's Pagalie....	2.38 4-5	Jaegar.
1913	A. P. Cunliffe's Aboyeur.	2.37 3-5	Louvois.
1914	H. B. Duryea's Dunbar II	2.38	Hapsburg.

For other racing records, see HORSE, TROTTING AND PACING.

HORSE-RADISH, a species of water-cress (*Radicula armoracia*), native to Europe, but now cultivated everywhere, and naturalized in many parts of the world. Its basal leaves are oblong, finely crenulate and irregular in outline, and its flowers are white and showy. The roots furnish the highly pungent ingredient of a well-known sauce, prepared by grating them, adding vinegar and sealing. They have also some medical use.

HORSE-RADISH-TREE. See BEN, OIL OF.

HORSE-SHOE ROBINSON: a Tale of the Tory Ascendency, was published by John Pendleton Kennedy in 1835 with a dedication to Washington Irving, whose 'Bracebridge Hall' Kennedy had already followed in his charming and truthful 'Swallow Barn, or a Sojourn in the Old Dominion' (1832). Cooper, not Irving, however, furnished the model for the later book, with the difference that whereas Cooper relied largely upon invention for his plots, Kennedy took plot as well as topography and costume almost directly from fact. Indeed, he founded the career of Horse-Shoe Robinson upon that of an actual partisan, one Galbraith Robinson, a blacksmith, whom he had met in South Carolina in 1819, and who later approved the record as authentic — "excepting about them women, which I disremember," he said. The love affair thus referred to is, as in most historical romances of the period, pale and conventional, but it is overshadowed by stirring adventures drawn boldly upon a broad canvas. The story opens with Charleston in British hands and carries the account excitingly through all the fratricidal violence of Whigs and Tories to the crucial, decisive battle of King's Mountain, which in 1835 already belonged to the folklore of the Carolinas. Romance as it is, 'Horse-Shoe Robinson' has genuine historical value for its representations of Revolutionary manners in the South. The leading personage, though full of the simple virtues with which the early republic endowed its heroes, just misses greatness by the lack of the touch of genius and poetry which made Leather-Stocking supreme in the class to which, however, Horse-Shoe Robinson also belongs.

CARL VAN DOREN.

HORSEFIELD, Thomas, American naturalist and explorer: b. Bethlehem, Pa., 12 May 1773; d. London, England, 1866. He was graduated in medicine at the University of Pennsylvania, and served as "medical apprentice" in the Pennsylvania Hospital from 1794-99, being the fifth interne in the hospital in the order of appointment. In October 1799 he accepted service as surgeon on the *China*, about to sail for Java. He returned in the latter part of 1800, but in 1801 went again to Java for the purpose of thoroughly exploring the island, and was commissioned as regimental surgeon by the Dutch Colonial government. From 1802 he devoted himself to the thorough examination of the flora, fauna and geology of the island, at first under the auspices of the Dutch government, and, when possession of Java was taken by the English, under the especial patronage of Sir Thomas Stamford Raffles, the lieutenant-governor. A warm friendship, due to kindred tastes, sprang up between Horsefield and his celebrated patron, and, when the English tenure of Java ceased and Sir Stamford Raffles returned to England, Horsefield accompanied him, bringing with him the collections he had made, which were placed in the museum of the East India Company in London, of which he was presently made the curator, a position which he held for nearly 50 years until his death. Horsefield, by his explorations and writings, laid foundations for our knowledge of the natural history of the far East. He contributed while in Java many important papers to the publications of the Batavian Society of Arts and Sciences. In 1824 he gave to the world his great work entitled 'Zoological Researches in Java and the Neighboring Islands,' and from 1838-52 issued in folio parts the 'Plantæ Javanicæ Rariores.' Both works are sumptuously illustrated by colored plates. In 1856-58 he published the 'Catalogue of the Birds in the Museum of the East India Company,' and in 1857-59, with Frederic Moore, the 'Catalogue of the Lepidopterous Insects in the Museum of the East India Company.' Besides these larger works he was the author of a multitude of papers published in the 'Transactions' and 'Proceedings' of societies. To him perhaps more than to any other single naturalist are we indebted for the first correct account of the botany and zoology of the regions with which he became familiar in his early life.

HORSEFISH. See MOONFISH.

HORSEFOOT CRAB, HORSE-SHOE CRAB, or KING CRAB. This marine animal (*Limulus polyphemus*) was formerly regarded as a crustacean, and is the sole survivor of an extinct group of arthropods intermediate between the trilobites and arachnids. It belongs to the order *Xiphosura*, class *Merostomata*, and phylum *Palæopoda*. By some English authors it is regarded as an arachnid allied to the scorpion. This difference of opinion regarding its affinities is due to the generalized structure of the animal, and to the fact that its nearest allies are extinct.

The body of the horsefoot crab is sometimes two feet in length, and consists of a head and a hind-body or abdomen, the latter ending in a long spine (telson), which is elevated by the creature in defense. The head is covered by a broad carapace, and is in shape somewhat like a horse's hoof, and in burrowing it acts as a shovel, being bent down at nearly right angles to the hind-body. There are a pair of compound and of simple eyes; the mouth is on the under side, nearly surrounded by six pairs of walking legs, while on the hind-body are six pairs of broad swimming legs. There are no antennæ, jaws, maxillæ or foot-jaws, as in the lobster. The horsefoot crab breathes by means of gills attached to the under side of the last five pairs of abdominal legs, which consist of a pile of about 100 thin broad sacs growing out, one pile on each side, from the base of the legs. The nervous system is peculiar from the nature of the brain, and the œsophageal ring; while the entire system behind the brain is enveloped by the arteries, the latter ending in remarkably fine branches. The heart is large, tubular, the liver very voluminous, and the kidneys are represented by four pairs of excretory red glands, arising from a stolon-like base. The animal is bisexual, the male differing from the female in the second pair of legs ending not in a forceps, but in a sort of hand, with an opposing thumb. The ovaries and testes are voluminous, and the sexual products, eggs and sperm, pass out through a pair of papillæ situated on the under side of the first pair of abdominal legs.

The female lays her large round eggs loosely in the sand between high and low water, spawning in May and June; in about a month they hatch, and the young, after passing late in embryonic life through a trilobite stage, assumes the form of the parent, differing in the short rudimentary caudal spine. It molts frequently, and during the process the front edge of the carapace or head splits open, enabling the animal to draw itself out of the old shell. The recently hatched Limulus is strikingly like a trilobite, but while in the latter new segments are added after birth, in Limulus no new ones are added. The young horsefoot is about four millimeters in length. Specimens an inch long are about a year old, and it probably requires several years to grow to the length of a foot or more.

Limulus polyphemus inhabits the eastern coast of North America from Boothbay, Me., to the West Indies and Honduras, but is most abundant in shallow, retired, sandy or muddy bays on the coast of New Jersey, Virginia and North Carolina. Several other species inhabit the seas of the Eastern Archipelago, China, Philippines and southern Japan. In the United States it is used as a fertilizer, while in the Malayan markets the animals are sold as food.

The Limuli date from the Devonian. An allied group, in shape and structure approaching scorpions, is the Eurypterida, one of which (*Stylonurus laccoanus*) of the Devonian of New York and Pennsylvania was about five feet in length, while the British *Pterygotus anglicus* is estimated to have been about six feet in length and two feet across. It is now thought that the scorpions have descended from some merostome, which became adapted for a terrestrial life. See EURYPTERUS.

HORSEHEADS, N. Y., village, in Chemung County, on the Erie and Central New

York, and branches of the Delaware, Lackawanna and Western and the Northern Central railroads, about six miles north of Elmira. It is in a fertile agricultural region. Its chief manufactures are creamery products, bricks, screens, doors, blinds, men's clothing, cigars, cattle-feed, shoes and hardware. Pop. 1,778.

HORSEMANSHIP. See RIDING.

HORSESHOE BEND, Battle of, in the War of 1812. When Jackson reached Fort Strother after his battles at Emuckfaw (q.v.) and Enotachopco, many of the volunteers returned home, thus forcing him into temporary idleness, but in February 1814 some regulars arrived and, therefore, as others of his volunteers had but a month more to serve, Jackson, on 16 March, dropped about 30 miles down the Coosa River and then started eastward for the Tallapoosa River, in the great loop of which, at Tohopeka, 800 Ocfuskee Indians had erected a fort and there had taken refuge with their women and children. On 28 March, with 3,000 effectives, Jackson camped about six miles from Horseshoe Bend and the next day made the attack. He sent General Coffee to gain the southern bank of the river, encircle the bend and assault from the rear while he attacked in front. Coffee's men attacked and set fire to the Indian huts, whereupon Jackson furiously assailed the breastwork on his side and finally carried it with some loss. The Indians asked no quarter and kept up a hopeless resistance until darkness ended the combat, when they sought refuge in the thickets; but the brush was set afire and as the Indians emerged they were shot. The slaughter was terrible, 557 warriors having fallen in the fort while many were shot swimming across the river so that only 200 are believed to have escaped. The prisoners numbered 304. Jackson's loss was 51 killed and 150 wounded. This battle destroyed the Indian power, and on 9 Aug. 1814, Jackson signed a capitulation and treaty with the Creeks whereby a large portion of their lands was ceded to the government. (See CREEKS). Soon afterward Jackson went to defend New Orleans (q.v.). Consult Adams, Henry, 'United States' (Vol. III, pp. 251–261); 'American State Papers, Indian Affairs' (Vol. 1, p. 826); Brackenridge, H. M., 'History of the Late War' (pp. 194–195); Fay, H. A., 'Official Account' (pp. 179–181); Lossing, 'War of 1812' (pp. 779–780); Monette, 'Valley of the Mississippi' (Vol. II, p. 421); Wiley and Rines, 'The United States' (Vol. V, pp. 454–456); biographies of Jackson by Parton (Vol. I, pp. 479–523); Buell (Vol. I, pp. 324–329), and Frost (pp. 231–236).

HORSESHOE FALLS. See NIAGARA FALLS.

HORSESHOE SNAKE, a large colubrine serpent of Spain and North Africa (*Zamenis hippócrepis*), so called from a horseshoe-like mark on its nape, and renowned for its fierce disposition, as is characteristic of the genus (rat-snakes) to which it belongs. It is yellowish above, strikingly marked with a variety of blackish lines and spots; the underside is yellow or red. Its usual home is in the burrow of some ground-squirrel or similar animal sought as prey, and it frequently enters the dwellings of men.

HORSESHOEING. See HORSE, CARE AND DISEASES OF.

HORSENS, Denmark, a seaport in the province of Aarhus, at the head of the Fjord of Horsens, distant from Aarhus by 32 miles southwest. The principal industries are ironworking, shipbuilding, the manufacture of woodenware and lime, and weaving. The chief imports are hay, grains and fertilizers; the exports are meats and dairy products. Pop. about 25,000.

HORSFORD, Eben Norton, American chemist: b. Moscow, N. Y., 1818; d. 1893. He received his education in the civil engineering course of the Rensselaer Polytechnic Institute, and in 1839 was employed on the geological survey of New York State. From 1844–46 he studied chemistry under Leibig in Germany, and on his return to the United States received the Rumford professorship in applied science at Harvard. In 1863 he resigned this post to engage in business. Mr. Horsford was known for his antiquarian research, especially in regard to his studies concerning the old Norse settlement which he supposed to be on the Charles River; and for his philanthropy. He endowed the library and a splendidly equipped laboratory at Wellesley College. He published a dictionary of the Iroquois and Algonquin languages; and the 'Discovery of Norumbega' (1892).

HORSLEY, hôrs'lĭ, **John Calcott,** English painter: b. London, 29 Jan. 1817; d. 18 Oct. 1903. After studying in the schools of the academy, he made his début in 1836 with 'The Pride of the Village' (Vernon Gallery) at the Royal Academy. He then devoted himself to genre paintings, among which the most famous are 'Malvolio' and 'L'Allegro' and 'Il Penseroso' which he painted for the Prince Consort. The Westminster Hall competition awarded him first prize for his cartoon of 'Saint Augustine Preaching' (1843). In the following year he executed frescoes for the houses of Parliament. He organized the winter exhibits of the "Old Masters" at Burlington House after 1870. His protests against paintings in the nude won for him the nickname in *Punch* of "Mr. J. C(lothes) Horsley." The Royal Academy elected him member in 1864, of which society he was treasurer from 1882–97, when he retired. Mr. Horsley published his memoirs under the title 'Recollections of a Royal Academician' (New York 1904).

HORSLEY, Samuel, English clergyman: b. London, 15 Sept. 1733; d. Brighton, 4 Oct. 1806. He studied law at Trinity College, Cambridge, and then received the living of Newington Butts in Surrey, which his father had held before him. It is in connection with his spirited attacks on Dr. Joseph Priestley's doctrines as set forth in the latter's 'History of the Corruptions of Christianity' and the controversy which followed that Horsley is chiefly known. In 1781 he became archdeacon of Saint Albans and in 1788 was promoted to the see of Saint David's. Subsequently he was bishop of Rochester (1793), and of Saint Asaph's (1802). Besides his controversial works and sermons, he edited the works of Isaac Newton (5 vols., 1779–85); wrote several treatises on mathematics, and also 'On the Prosodies of the Greek and Latin Languages' (1796), and translated several books of the Bible. Posthumously various collections of his works were made: 'Speeches in Parliament' (1813); 'Collected Theological Works' (6 vols., 1845).

HORST (German, the top of a rock), a term applied to a block of the earth's crust lying between two faults and upthrown relative to the adjacent blocks; also applied to the topographic elevation so formed. The opposite of graben (q.v.).

HORSTMANN, Ignatius F., American Roman Catholic prelate: b. Philadelphia, Pa., 16 Dec. 1840; d. Cleveland, Ohio, 13 May 1908. In 1857 he was graduated from the Central High School, and afterward attended Saint Joseph's College, Philadelphia. He went to the Preparatory Seminary of Glen Riddle in 1859, and in 1860 entered the American College, Rome, where, after completing his course, he was ordained priest by Cardinal Patrizzi, 10 June 1865. In 1866 he took in Rome the degree of doctor of theology, and in the same year returned to Philadelphia and accepted the chair of mental philosophy in the diocesan seminary of Saint Charles Borromeo, continuing to hold the same position in the new seminary at Overbrook. In 1877 he became pastor of Saint Mary's Church, Philadelphia, and in 1885 was named chancellor of the archdiocese. On 29 Nov. 1891 Leo XIII appointed him to the vacant see of Cleveland, Ohio, and he was consecrated bishop 25 Feb. 1892.

HORT, Fenton John Anthony, British theologian: b. Dublin, 23 April 1828; d. Cambridge, 30 Nov. 1892. He studied at Cambridge, becoming Fellow there in 1852. In the following year he undertook with B. F. Wescott an edition of the Greek New Testament, and founded with others the *Journal of Classical and Sacred Philology*. He received ordination in 1856, and became vicar at Saint Ippolyts, near Cambridge. However, the scholastic life held more attraction for him and he returned to Cambridge, where he rose from examiner to a professorship in 1878. His edition of the New Testament appeared in 1881, a monumental and authoritative work. His 'Introduction to the New Testament in Greek' is a fine scholarly production. Numerous treatises and lectures have been published posthumously, including 'The Way, the Truth, and the Life' (London 1893); 'Judaistic Christianity' (1894); 'Lectures on the Ante Nicene Fathers' (1895); 'Prolegomena to Romans and Ephesians' (1895); 'The Christian Ecclesia' (1897); 'Village Sermons' (1897); 'Village Sermons in Outline' (1900). Consult Hort, A. F., 'Life and Letters of F. J. A. Hort, by his Son' (2 vols., London 1896).

HORTENSIUS, hôr-tĕn'shĭ-ŭs, **Quintus,** Roman dictator, about 286 B.C. He was chosen to settle the differences between the plebs and the Senate, which had resulted in sedition and their secession to the Janiculum. Hortensius enacted the Lex Hortensia, by which resolutions passed by the plebs were made binding on the whole people, without the Senate's approval.

HORTENSIUS, Quintus, who was surnamed HORTALUS, a Roman advocate, and who flourished in the time of Cicero: b. 114 B.C.; d. 50 B.C. At an early age he showed remarkable ability as an orator, and his skill won for him the successive offices of quæstor (81); ædile (75); prætor (72) and consul (69). The remainder of his life he spent in practise of law and became distinguished in pleading of cases. His oratory was insincere for the most part and very flowery. He opposed Cicero in the cases of Verres, and his failure to win the trial was the turning point of his career. Thenceforth, Cicero occupied the position of leading orator. The works of Hortensius have not been preserved.

HORTICULTURE, the art of growing, improving, propagating and utilizing fruits, vegetables and flowers for food and for ornamentation. While horticulture is strictly an art, it is grounded in and supported by many branches of science, all of which play an important part in the success of the work. Although the sciences of plant physiology, chemistry and physics may aid greatly in all branches of horticulture, there have been, are still and will no doubt continue to be men endowed with natural gifts who must be regarded as masters in this field, to whom the sciences as such remain unknown. The degree to which plants may intuitively be molded, shaped and made to respond to the needs of man are little short of marvelous. Science with all its power cannot always accomplish the ends secured by the skilled craftsman who knows plants and loves them, who may work wonders with them himself, but who may be unable to pass this knowledge on to others. While the word horticulture is still retained for a large number of activities, the field has become so extensive that there are now well-recognized groups. No hard and fast lines can be drawn between these groups, but they are generally recognized as more or less distinct and are as follows: (a) Fruit growing, or pomology; (b) Vegetable growing; (c) Flower growing, or floriculture; (d) Landscape art.

Fruit Growing, or Pomology.— Fruit growing embraces all those practices having to do with the production, handling and within certain limits the utilization of fruits. Here again it is impracticable to draw any arbitrary lines between products commonly classed as fruits and those classed as vegetables. The tomato is a fruit, but the tomato grower may be either a trucker or a vegetable gardener. He would not be classed as a pomologist or a fruit grower. In America fruit growing embraces the production of fruits like the apple, pear, peach, plum, apricot, quince, orange, lemon, and a considerable number of products from trees, vines, bushes, and even soft wooded plants like the strawberry, banana and papaya. Fruit growing as a whole has been more highly developed commercially in America than in any other country. The last decade has shown progress in the standardization of methods and practices. A striking feature of the past 20 years' development in fruit growing, especially with the apple, has been the demonstration of the fact that the more successful operators are those who live with their trees, who work with them and know them, and that orcharding by proxy through corporations or syndicates is in large measure a failure. In the necessary keen competition that exists in the production of a high-grade fruit like the apple, the limiting factors are of such a nature that their recognition and control cannot be syndicated or reduced to mathematical formulæ so that an individual may expand his activities indefinitely. An apple grower who owns his orchard of 40 to 60 acres, who knows his trees and lives with them may be highly successful, but if he attempts to expand his activities and oversee several hundred acres, the chances are that he may fail or else become a mediocre grower. In the light of developments during the past 20 years, we may, therefore, look forward to commercial fruit growing as more or less of an industry preëminently suited to individual effort so far as production is concerned. The handling and marketing, however, are matters that lend themselves to organization, but of these points we shall speak later.

The latest available figures indicate that the total value of fruits produced in the United States is somewhere around $250,000,000 to $300,000,000 annually. The deciduous tree fruits like the apple, pear, peach, plum, apricot and quince represent at least two-thirds of the total value of all fruits. Quoting the available figures in percentages, deciduous tree fruits represent about 65 per cent of the total value, citrous fruits 10 per cent, grapes 10 per cent, small fruits 14 per cent, miscellaneous fruits (mostly subtropical) 1 per cent. The apple leads in quantity and value of fruits grown. It also leads in distribution and may without question be characterized as the most important fruit in the United States. More than one-half of the farms in the United States, of which there are now nearly 6,500,000, produce apples. The quantity of fruit produced is quite variable, running all the way from 125,000,000 to 225,000,000 bushels a year. The last census figures give the number of bearing trees as 151,322,340 and the yield as 146,122,318 bushels. About 500 different varieties of apples are reported as being offered by nurserymen for planting. Of these, however, 30 to 35 varieties constitute the chief source of this valuable fruit. About one-fourth of all the apples grown in this country are of two varieties — namely, Baldwin and Ben Davis. The principal apple-growing States in the order of quantity produced and value of fruit are New York, Washington, Missouri and Pennsylvania. The great centres of apple production are to be found in southern Maine, southern Vermont, eastern Massachusetts and Connecticut, western New York, western Pennsylvania, the Appalachian region of Virginia, West Virginia and North Carolina, southern and western Missouri, southern Michigan and western Washington and Oregon.

Next to the apple, the peach and nectarine rank in importance in deciduous fruits. Production is variable, ranging from 15,000,000 to 66,000,000 bushels annually. Except in the State of California, the peach, probably more than any other tree fruit, is subject to the vicissitudes of climate. The trees in even the most favored regions are subject to winterkilling. If they survive the winter, the crops may be greatly curtailed or entirely destroyed by late spring frosts. Most of our valuable varieties of peaches owe their parentage to natives of warm climates. The peach, therefore, is prone to respond quickly to a few warm, sunny days, only to be injured when severe cold follows, as is likely to be the case in many parts of our country. The principal peach producing States are California, Georgia, Mississippi, Texas, New York, Pennsylvania, Ohio, Arkansas and Missouri, in about the order named. The yield of peaches, as given for the last census year (1909), was in round numbers 35,000,000 bushels. The estimated yield for 1915, a banner year, was 64,000,000 bushels. The estimated yield for 1917 was in round numbers 45,000,000 bushels. Certain regions in the States named have become more or less centres of intensive peach production. Such regions are to be found along the southern shore of Lake Ontario in New York State, on the eastern shore of Lake Michigan in the southern Michigan Peninsula, in central and northern Georgia, eastern Texas, western Arkansas and the lower part of the Sacramento Valley in California.

Plums and prunes are pretty widely grown over the whole United States east of the Mississippi River. California, Oregon and Washington, however, are the great centres of production, especially of the prune. The quantity of these fruits produced is between 15,000,000 and 20,000,000 bushels a year, of which California produces at least one-third.

The pear constitutes an important crop. Its production is more stable than the peach and to a certain extent pear growing as an industry may be regarded as less risky than peach growing. The limiting factor in pear growing is fire blight, a disease which destroys many thousands of trees annually, and which has brought about the need of a system of continuous planting in order to keep the orchards intact. The annual production of pears during the last 10 years is close to 11,000,000 bushels. California is the leading pear-growing State, with New York a close second. Oregon and Washington are also large producers of this fruit. The latest available figures, which are estimates for 1916, give the yield of pears in California as 3,124,000 bushels; Washington, 551,000 bushels; Oregon, 555,000 bushels, and New York, 1,675,000 bushels. The estimated yield of pears for the whole of the United States for 1917 is 13,281,000 bushels, valued at $15,379,000, or an average of $1.15 per bushel.

The production of cherries may be regarded as a minor fruit industry in this country. California ranks first in quantity produced, with Pennsylvania second. Grape growing is pretty widely disseminated, although the large commercial plantings are centred in certain regions, principally in California and New York. The annual value of the grape output of the country is in round numbers about $23,000,000. California produces between 70 and 75 per cent of the total crop. The State of New York is second in production, with something like 250,000,000 pounds to her credit. Michigan is third, with 121,000,000 pounds.

Citrus growing, especially the orange and grapefruit, has become one of the most highly organized intensive horticultural industries in this country. The latest estimated figures as to the quantity of oranges produced give 12,282,000 boxes for 1917. The production in 1916 is estimated at 24,433,000 boxes, valued at $61,463,000. According to the latest census figures (1909), there were produced in the United States 19,487,000 boxes of oranges, 2,770,000 boxes of lemons and 1,189,000 boxes of grapefruit. About 75 per cent of the oranges were grown in California and 25 per cent in Florida. The grapefruit industry is practically confined to Florida, while lemon growing is confined almost entirely to California.

Of the small fruits produced in the United States, those leading are the strawberry and the raspberry. According to the census figures, the total production of strawberries in the United States was 256,000,000 quarts. Maryland is the leading strawberry producing State, with New Jersey second.

Fruit growing may be commercial or noncommercial, with varying intermediate types involving features of both. Commercial fruit growing has to do with all those matters of location and sites for orchards, securing of young trees, planting, cultivating, pruning, spraying and harvesting of the fruit. In keen competition all of these matters become important, some, of course, more important than others. The successful commercial fruit growers are those who are able by good judgment and foresight to bring about conditions most favorable to the production of the particular fruit in which they are interested. Many men go into the business who are not fitted for it and who do not have the proper conception of the knowledge required to be successful. It is quite remarkable that many men who have been successful in some manufacturing or similar commercial enterprise as a result of long study and experience should become possessed of the idea that they can embark in fruit growing and make a success of it without knowing much about the subject. It must be borne in mind that orcharding is a business that cannot be learned in a month, or a year or a series of years. There are a good many people who can never learn it. There is always room for the right man in this work. Given the right man and one who knows or can learn the methods, and success is assured.

As a business, fruit growing is more profitable than farming, but the risks are greater. The element of risk has its fascination, but unless one is temperamentally suited for this sort of thing, he had better occupy himself with some line of work less hazardous. A big money-making crop of fruit is usually the result of a combination of circumstances and conditions. Some of the conditions are not controllable. A good many of them are controllable. The grower must have patience and nerve, for he may go along for a number of years with nothing but expenses and hard labor to show for his efforts. If in discouragement he relaxes his efforts or his vigilance, if he decides for a year to omit proper fertilization, proper spraying, or cultivation, taking a chance, as it were, when the time comes for the big strike his trees will likely fail him. If the grower, on the other hand, has kept himself keyed up and has done the things he should have done, he may in one year make enough to pay a handsome profit on his own labor and his investments for a considerable period of years.

Within the past decade great progress has been made in the handling and marketing of fruit. Gradually the producers themselves are assuming control of these matters and are thereby enabled to strengthen their business and increase their profits. Various associations, exchanges and other organizations have been developed for the purpose of standardizing the product, ensuring uniformity, a more equitable distribution, the avoidance of gluts, mutual help in transportation matters, and in the purchase of materials and supplies used in the final disposition of the fruit. Some organizations have entered the selling field so that the growers practically control the product from their own hands directly to the consumer. The citrus growers of California are more highly organized than any other fruit-growing group in the country. During the past 10 years the California Citrus Exchange has worked a revolution in the growing, handling and marketing of the orange crop of that State. The California Citrus Exchange is a leader in this field and has pioneered a way that has proved just and equitable to all concerned.

Vegetable Growing.— Vegetable growing may for convenience be considered under three heads: Market gardening, truck farming, home gardening.

Market gardening as a commercial enterprise has developed in this and other countries largely as a concomitant of the growth of large cities. The city must be fed, and as an important part of the food supply consists of fresh vegetables, it was but natural that the production of these vegetables should attract men of energy and foresight, with the result that a very important business has developed. As the cities grew, many of the market gardeners were forced to go further out into the country in order to find land sufficiently cheap to warrant its use for intensive cropping. Not an inconsiderable number of the earlier market gardeners who owned land within the city limits were able to realize handsomely on the land, for the increase in real estate values were rapid and great. The advent of the trolley car, the extension of good roads, the difficulties of securing sufficient quantities of stable manure in the city, especially from the street car companies, the coming of the automobile and the motor truck have all profoundly affected this business. Being an extremely intensive line of work, and as every foot of soil must be used and doubly used, the market gardener can afford to continue cropping his land even when values have reached several thousand dollars per acre. It is not unusual for a good market gardener to take from $1,000 to $2,000 worth of produce from an acre of land in the course of a year. This is accomplished, furthermore, without the aid of glass or other forcing equipment or forcing methods. The area handled by market gardeners is relatively small, running from two to three acres to as high as 50 to 60 acres in exceptional cases. It is not uncommon to find men who have brought up their families, educated their children and put away something for the future on three or four acres of land devoted to market gardening. Handled properly, land devoted to market gardening should give a net profit of from $300 to $700 a year per acre.

The use of glass in forcing vegetable crops greatly intensifies the work. Some market gardeners use nothing but glass, either as greenhouses or frames or both. The principal crops forced under glass are lettuce, cucumbers, tomatoes and radishes. A considerable number of other crops are also forced, but the forenamed are the leaders. Handled properly, glass houses may be made to yield a gross return of from 30 to 50 cents per square foot of bed space covered. The average will probably be somewhere from 30 to 40 cents per square foot. There are many acres of glass devoted to this work in the vicinity of our large cities, especially Boston, New York and Chicago. No late figures are available as to the extent of the industry. It would appear from the data at hand that from 60,000,000 to 75,000,000 square feet of glass would fairly represent the extent of this industry. Probably two-thirds of this glass is in well-constructed houses, the remainder being in cold frames and hotbed sash.

Truck growing as an industry is of comparatively recent origin. Little was heard or known of truck growing prior to the Civil War. Improvements in transportation, and especially the wider use of the refrigerator car, and the better organization of marketing and selling agencies have tended to greatly enlarge the scope of this work. Moreover, the people of the country, even in the remote villages, have been educated to the use of fresh vegetables in winter. Improved transportation facilities have made it practicable to deliver these fresh vegetables at nearly all seasons of the year. Truck growing has for its primary object the production of large quantities of certain standard vegetable crops, such as cabbage, kale, spinach, potatoes, sweet potatoes, green beans, tomatoes, eggplant and lettuce. The principal trucking regions are to be found near the seaboard in southern New Jersey, Delaware and Virginia, especially the vicinity of Norfolk, the eastern coast of North Carolina, South Carolina and the coastal plain sections through Georgia and Florida. A large trucking area is also to be found in the Gulf States, especially in southern Alabama, Mississippi, Louisiana and Texas. Considerable development in truck growing has come about in the interior of some of the Southern States, notably Kentucky and Oklahoma. Trucking is also developing considerable importance in the Western States, including parts of New Mexico, Arizona, Nevada and California. No authentic figures as to the extent of truck growing are available since those published in 1909. There have been rapid changes since that time. On the eastern shore of Maryland and Virginia the increase in potato growing has been very great, owing in part to the perfection of an efficient, organized plan of assembling, growing, handling and marketing the product. Reliable estimates would indicate that the increase is over 2,000 per cent since the last census was taken. The increase in the Norfolk, Va., section has also been large, aggregating 40 per cent or more for all truck crops. A striking example of the growth of a special truck industry is found in early Irish-potato growing in Florida. From a small area of something like 1,200 acres planted in 1900, the land devoted to this crop had increased to 16,000 acres in 1915. Florida, with its light, sandy, warm soil, its relatively warm winter climate and its excellent transportation facilities by land and water to the markets of the North is preeminently suited to truck farming. The total area devoted to the vegetable industry in Florida for the census year 1909 was 67,442 acres. In 1915 the estimated area was 99,162 acres, an increase of 47 per cent in six years. On account of the nearly universal demand and the ease of transportation and handling, lettuce constitutes one of the important trucking crops. Florida leads as a lettuce-producing State, the land planted being in the neighborhood of 5,000 acres. An acre of lettuce will yield from 30,000 to 40,000 salable heads, so that the annual output of lettuce from Florida alone is somewhere near 200,000,000 heads.

The production of green vegetables for canneries may be considered as a feature of truck growing. The field requirements for the production of the different crops are similar and the methods followed are for the most part the same. Sweet corn, tomatoes and peas are the principal crops grown. The latest figures indicate the land devoted to these crops for canning as being nearly 450,000 acres. Sweet corn leads with nearly 200,000 acres, tomatoes follow with something like 150,000 acres, and peas show approximately 100,000 acres. From a dozen to 14 different kinds of vegetables are grown in considerable quantities for canning purposes. All of these are grown under the best trucking conditions and in accordance with up-to-date trucking methods.

The home vegetable garden as a feature of horticultural activity has come to be recognized as an important adjunct to our national system of food supply. This is especially true since the great increase in the demand for food as a result of the World War. The home vegetable garden has unquestionably played an important part in producing wholesome and valuable foods for the home. The great interest aroused in this work owing to abnormal conditions is likely to continue even when matters assume their normal state. As countries grow older and more thickly populated, there develops on the part of the people a love for working in the ground. It is found that these activities satisfy a natural craving for creative and productive work, making for contentment, health, happiness and the prolongation of life.

Floriculture.— The growing of flowers or ornamental plants as a commercial industry has come to be an important one during the past two decades. The greater part of this work is done under glass and the business now reaches into millions of dollars annually. The great centres of flower production are near the large cities. There are now between 10,000 and 12,000 establishments in this country engaged in floriculture, with an annual output of $35,000,000 to $40,000,000. The States leading in the production of flowers are New York, Pennsylvania, Illinois, New Jersey and Massachusetts in the order named. Census figures show 114,655,276 square feet in glass houses in the United States. There is also reported 9,489,556 square feet in sashes and frames. In the earlier days of floriculture in this country the business was general — that is, a miscellaneous assortment of plants for bedding and home adornment were grown, together with plants for cut flowers. Gradually specialization developed, with the result that there are now rose specialists, carnation specialists, violet specialists and other specialists. Rose growing under glass from the standpoint of money invested and annual returns is probably the most important floricultural industry. The growing of the carnation is a close second, with the violet third. Rose growing and carnation growing have developed to a marked degree near certain points. Climate and soil do not seem to have had very much influence in bringing about these centres of industry in the growing of roses and carnations, except that the most successful establishments are to be found in the more northern portions of the country. The changeable climate of the Southern States is not suited for the forcing of these crops under glass. With the violet, however, climate seems to play a more important part in the success of the industry. Somewhat uniformly cold weather during the winter months, accompanied by a maximum of sunlight, gives the best conditions for the production of the violet. The production of bedding plants and ornamentals for outside planting constitutes an important phase of the industry. The forcing of a long list of specialties for the Easter and holiday trade should also be noted. Lilies of various kinds, numerous hard wooded plants, tulips, hyacinths, narcissus, and other bulbous stock are now forced in large quantities. A great deal of the stock is grown abroad and is imported by the florist for purposes of forcing.

A feature of floriculture is the business enterprise shown in the maintenance of beautiful stores and shops in nearly all of our cities. Most of these establishments grow some or nearly all of the flowers and plants they sell. A valuable educational feature of the work of the various flower stores is to be found in the constantly changing beautiful window displays. The florists are well organized nationally and locally. Some of the more important national organizations are "The Society of American Florists and Ornamental Horticulturists," "The American Rose Society" and "The American Carnation Society." The mechanical improvements and developments in the construction of forcing houses have been marked during the past decade. In the early days the houses for the most part were low, relatively small, and constructed of wood in such fashion that plants were subjected to rather unfavorable conditions, especially during the winter months. More recently, iron and steel have come to be used quite generally in the construction of much larger and better lighted houses, all well ventilated and heated. Many of these houses are of large size, sometimes covering acres of ground. The construction of glass houses and the utilization of glass houses for the growing and forcing of plants has advanced more rapidly in this country than in any other country of the world.

Landscape Art.— Landscape art or landscape gardening is the development or creation of landscape pictures through the proper and artistic use of plants, roadways, walks, drives, water courses, lakes, etc. In a broad sense the term landscape architecture is sometimes used. This term, however, applies to matters outside the realm of horticulture, hence does not concern us here. Landscape gardening involves not only a knowledge of how to use plants in the development of beautiful and artistic landscape effects, but it also involves broad horticultural knowledge regarding plant growing, propagation, plant habits, hardiness, tenderness, etc. Landscape gardening may be natural or formal, or it may be of many intermediate forms between these two styles. The tendency in America, as in England, is in the direction of the natural form in landscape work — that is, to make a beautiful natural picture, to bring into our dooryards or into our public or private parks, large or small, a bit of nature as we frequently see it in the woods or in the fields. Formal landscape work has its place, but it is limited. Even in cities where everything is formal, it is coming to be recognized that bits of natural scenery are appreciated by the people. A study of the history of landscape work shows that it has been profoundly influenced by the literature and thought of the people of the time. Japanese landscape designing, for example, is in a measure an expression of the soul of the people. To us much of their work may seem purposeless and meaningless, but probably nowhere in the world has so many meanings been put into an art as in the landscape art of Japan. Plants and flowers are not always necessary for landscape work in Japanese designs. Stones may be used to symbolize such ideas as peace, old age, contentment, etc. Japanese gardening has been introduced here and some fine examples of it are to be found in various parts of the country. Within recent years there has been a great awakening of the public, especially in the older and more thickly populated centres, in home beautification and community effort in civic improvement. The rapid growth of suburban villages, owing to better facilities for transportation, has made practicable an expression of the love for gardening in the adornment of the home lot, the village street and the village community centre. The nature study movement, the home improvement clubs, the civic centre clubs have all contributed to wider interest in landscape work. The advances in educational work in horticulture should be noted. The pedagogical value of horticulture, or a knowledge of plants, how they grow and live, has come to be recognized and is now applied in the elementary and secondary schools in many sections of the country. Horticulture is not taught with the object of turning the minds of the pupils especially toward plants and crops, but the subject is recognized as a means of awakening the mind, developing the observational powers and in other ways aiding in the physical, moral and mental growth of the pupils. The school garden work is gradually assuming an important rôle in educational effort. This is particularly true of rural schools, where theory and practice may be co-ordinated through classroom work with what has come to be called the home project. The pupil gets the basic ideas in the classroom and proceeds to apply them under the direction of the competent teacher in the carrying out of a definite piece of work like the care of an orchard, a vineyard or a garden in his or her own home. Through these activities the proper foundation is laid for broader work in the State agricultural colleges and universities. Nearly all the State universities and agricultural colleges now have well-organized departments of horticulture. A considerable number of the institutions have gone farther and have separated horticulture into the four classes discussed here. In these institutions these classes are recognized as separate and distinct departments with separate and distinct courses of study. The increasing work of the State agricultural experiment stations has created a demand for trained men in horticulture, consequently the courses at nearly all the institutions are sought by young men and young women who recognize in the work a fine field for professional service as well as one where excellent training in the growing and selling of many horticultural products which the people demand may be secured for practical work on one's own place.

Bibliography.— The literature on horticulture is voluminous. The National Department of Agriculture, the State experiment stations and the State agricultural colleges are all turning out numerous bulletins and leaflets each year. There is scarcely a subject in the whole horticultural field that has not already been covered in the series of Farmers' Bulletins issued by the United States Department of Agriculture. The standard horticultural work is Bailey's ‘Cyclopedia of Horticulture,’ published in six volumes, with 3,639 pages and more than 4,000 illustrations. This valuable work was published 1900–02; new edition 1917. Special works are White, E. A., ‘Principles of Floriculture’; Galloway, B. T., ‘Commercial Violet Culture’; Wilkinson, A. E., ‘The Apple’; Corbett, L. C., ‘Garden Farming.’

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HORTON, Robert Forman, English Congregational clergyman and author: b. London, 18 Sept. 1855. He was educated at New College, Oxford, and in 1879 he was made a Fellow of New College, and lecturer on history. In 1880 he became pastor of Lyndhurst Road Congregational Church, Hampstead. In 1893 he delivered the Lyman Beecher lectures at Yale. His writings include ‘History of the Romans’ (1885); ‘Inspiration and the Bible’ (1887); ‘The Teaching of Jesus’ (1895); ‘Women of the Old Testament’ (1897); ‘The Commandments of Jesus’ (1898); ‘England's Danger’ (1898); ‘The Pastoral Epistles’ (1901); ‘The Trinity’ (1901); Reunion of English Christendom’ (1904); ‘Does the Cross Save?’ (1905); ‘The Law of Spiritual Power’ (1906); ‘The Holy Spirit’ (1907); ‘My Belief’ (1908); ‘Great Issues’ (1910); ‘The Hero of Heroes’ (1911); ‘Reconstruction’ (1915); ‘An Autobiography’ (1917).

HORTON, Samuel Dana, American publicist: b. Pomeroy, Ohio, 16 Jan. 1844; d. Washington, D. C., 23 Feb. 1895. He was graduated from Harvard in 1864, and from the law school in 1868, and also studied abroad, especially in Berlin 1869 and 1870. He began the practise of law in Cincinnati, moving later to Pomeroy, but devoted himself mainly to the study of monetary questions, spending much time abroad; he was one of the first to advocate the establishment and maintenance of an international ratio between gold and silver. He was a recognized authority on all questions concerning coinage, was a delegate secretary of the American delegation to the international monetary conference at Paris in 1878, and a delegate from the United States at the conference of 1881; in 1889 he was again sent abroad by the President as a special commissioner; shortly before his death he went to Washington at the request of the administration for a conference concerning the financial situation. His writings include ‘Silver and Gold and their Relation to the Problem of Resumption’ (Cincinnati 1876); ‘The Silver Pound and England's Monetary Policy since the Restoration’ (London 1887); ‘The History of the Guinea’ (London 1887); ‘Silver in Europe’ (New York 1890). He also assisted in editing the proceedings of the conference of 1878 (Washington 1879) to which there is attached a vast body of documents, etc., collected and selected by him as ‘Historical Material for, and Contributions to the Study of Monetary Policy’ (in Senate Executive Document No. 58, 45th Congress, 3d Session, Washington 1879). The ‘Proceedings of the International Monetary Conference, etc., in Paris, April–July 1881’ (Cincinnati 1881) contain a number of addresses, remarks, etc., made by him in his capacity as delegate. Consult Walker, F. A., ‘S. D. Horton’ (in *Economic Journal,* Vol. V, p. 304, London 1895).

HORUS, an Egyptian god or group of gods to all of which the falcon was sacred. The term is supposed to mean “the upper or superior one.” Horus was patron of upper Egypt; was worshipped especially at Edfu and in time came to be the type of the king. See EGYPTIAN RELIGION AND SOCIOLOGY.

HORVÁTH, hôr'vät, **Michael,** Hungarian clergyman and statesman: b. Szentes 1809; d. 1878. Although he was trained for the priesthood and was ordained (1830), he reacted against this work, and was appointed professor of Hungarian language and literature at Vienna. His learning and sincerity of purpose won for him the appointment of bishop of Csanád (1848), and, when Hungary declared its independence, Horváth became Minister of Public Education and Worship (1848). After the popular government lost its power he spent several years in continental travel, and returned to Hungary in 1867. He sat in Parliament in the Lower House, sympathizing with the Deák following. His historical works are of great importance. They include ‘History of the Hungarians to 1823’ (3d ed., 8 vols., Budapest 1873); ‘Twenty-five Years of Hungarian History, 1823–48’ (2d ed., 1868); ‘History of the War of Independence in Hungary 1848–49’ (2d ed., ib. 1872).

HORWICH, England, a town in Lancashire, four miles west-northwest of Bolton. The chief industries are railway works, coal mining, paper and cotton manufacture and stone quarrying. The town owns its water supply. Pop. 16,500.

HOSANNA, hō-zăn'nạ, the cry of those who greeted Jesus on his last entry into Jerusalem (Matt. xxi, 9; Mark xi, 9; John xii, 13). The use of the word in different places has led to some disagreement of authorities as to its exact meaning. In Mark xi, 9 and John xii, 13, it stands alone; while in Matt. xxi, 9 and 15 it is followed by τῷ υἱῷ Δαυείδ, “to the son of David”; and in Matt. xxi, 9 and Mark xi, 10 by ἐν τοῖς ὑψίστοις, “in the highest.” Eminent critics regard it as derived from the Hebrew phrase meaning “save now.” On the authority of the use of the word in the early Christian doxological literature (Didaché x, 6), and also on the interpretations by Clement of Alexandria and Augustine, it is generally assumed that the word was a form of joyous interjection, equivalent to the English «Hail!» Consult Dalman, 'Die Worte Jesu' (Vol. I, Leipzig 1898); and Schmidt, 'The Prophet of Nazareth' (2d ed., New York 1907).

HOSEA, hō-zē'ạ, the first in order among the minor prophets of the Old Testament, but more probably the third in order of time. Nothing is known of his life, except what can be gathered from the introduction to his prophecies, namely, that he was the son of Beeri, and that his ministry belonged to the reigns of Uzziah, Jotham, Ahaz and Hezekiah, kings of Judah, beginning probably about the end of the reign of Jeroboam II, king of Israel. See HOSEA, BOOK OF.

HOSEA. A Hebrew prophet whose recorded ministry was slightly later than that of Amos, the first «writing prophet.» Hosea was evidently, like Elijah, a citizen of the northern kingdom, to whom the king of Samaria was «our King,» while Amos came from his home in Judah to preach in Israel. The first three chapters of the book of Hosea have as their historical background the closing years of the prosperous reign of Jeroboam II, which ended about 740 B.C. Chapters iv–xiv carry us into the first years of the period of anarchy that followed Jeroboam's death. The second part of the heading of the book — in the reign of Jeroboam the son of Joash — probably belonged to the original title of chapters i–iii, while the first part of the heading naming a series of Judean kings may have been added by a later editor in the southern kingdom, who knew that Hosea's ministry continued after the death of Jeroboam. Hosea's personal life was a tragedy; his wife, whom he loved with deep devotion, proved to be a wanton who left him for her lovers. At last, deserted of these, she fell into slavery and then her husband bought her back to protect her. Though he could not receive her now into the fellowship of a wife, he himself would marry no other. Out of such bitter experience as this, Hosea learned the great lesson of Divine love which he was the first to frame in human speech.

As a literary whole, the book is clearly divided into two main sections, corresponding to the two different periods of Hosea's ministry. (1) Chapters i–iii, Hosea's love and Gomer's faithlessness, an allegory of Jehovah and Israel, his faithless wife. (2) Chapters iv–xiv, a series of discourses on Israel's guilt and punishment, with glimpses of Jehovah's unchanging love and readiness to restore after purification.

The great question of debate in connection with this book has been the true character of chapters i–iii; do these reflect Hosea's actual experiences or are they pure allegory? The great difficulty in the way of literal interpretation has been that Hosea seems to say that he received Divine command to marry a woman who was a profligate. When it is recognized that the Hebrew prophets are wont to interpret God's guidance in the light of later experience and, in their vivid mode of speech, to style this guidance through experience as the command of God, the difficulty disappears. The succession of names given Gomer's children accords with the view that it was slowly through the years that the conviction of his wife's character was forced upon Hosea's mind. This interpretation fits, too, with the thought of the latter part of the book that Jehovah had betrothed Israel to himself as a pure bride and that afterward she proved untrue. The prevalent view to-day is accordingly that Hosea married one whom he supposed to be pure. To his first child he gave the name Jezreel as a prediction that Jehu's bloody work in the valley of Jezreel must be avenged upon his dynasty. As time went on and other children were born, he came to know that his wife was indifferent to him and sought other lovers. The names of the later children contain suggestion of their mother's faithlessness. In his own bitter sorrow, Hosea came to see and understand something of the sorrow of Jehovah's heart for a people blind to his loving care, who turned away unto other gods.

In the second part of the book, this blindness, ignorance of God, is the explanation of the complete dissolution of society that followed so quickly upon Jeroboam's death. The king's son reigned but six months and was then struck down by an assassin; a month later the murderer met a similar fate. Drunkenness and all debauchery characterized the upstart monarchs who in their political weakness turned now to Egypt and now to Assyria for support. In the land there was not truth nor knowledge of God; naught but swearing, lying, killing, stealing and adultery. Again and again the prophet returns to the root of the nation's troubles; that they know not Jehovah; their sacrifices are not acceptable because they have forgotten their Maker. In Hosea's time, the licentious symbols and rites of Canaanite Baal worship were still mingled with the worship of Jehovah, whose distinctive character was not understood. Through all that is hopeless in the second section of the book there runs also the deep current of conviction that Jehovah's love is unchangeable and that he cannot give up his people to irreparable doom, despite their sensual blindness. The prophet's thought swings between hope and doom as he contemplates now the brutishness of the people and now the unchanging heart of God. His experience of life has been too deep to permit him to fall into the childish error of supposing that the Divine love can obliterate sin and its effects where there is no answering love and penitence. He knows that there must be long and desolate expiation before there can be any future of hope for his nation. Hosea's ethical teaching corresponds with his conception of God. With him kindness is Jehovah's supreme demand for man's conduct toward man; but again he does not fall into the error of supposing that a sentimental kindness can supersede the claims of justice.

As poet and preacher, Hosea combines deepest insight with compelling emotion and a picturesqueness of speech that has rarely been surpassed in any age or nation. The influence of the rounded hills and broader, more fertile valleys of Samaria are felt in his pages, in contrast to the rugged wilderness reflected in the words of Amos. The luxuriant vine that putteth forth his fruit, the morning cloud and the dew that goeth early away are in pleasing contrast with the fierce and bloody pictures of man's deeds, and yet even these gentler aspects of nature are made, in the prophet's speech, telling means of presenting man's weak and wanton ways. In his intense emotion, the prophet identifies himself now with God and now with the people in a way that gives dramatic power to his words. Although the opening chapters reflect actual experiences of Hosea and Gomer, they picture also God and Israel in such a manner as to give the elements of a true allegory. Later in the book (chapter xi) the characters change from husband and wife to cherishing father and wayward son; here Hosea gives us the first clear presentation of God as the loving father, but it is the father of the nation, not of the individual. The full revelation of the relation of God to the individual must wait deep and terrible experiences of national failure.

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HOSIERY AND KNIT GOODS INDUSTRIES IN THE UNITED STATES.

Most of the history of the hosiery industry relates to inventions of knitting machinery. The first knitting machine, invented in 1589 by William Lee, an Englishman, knit a complete course at one operation. His machine had hooked, spring needles, which are still generally used. In Europe nearly all hosiery is knit on machines, the original type of which was patented in England by William Cotton, in 1864. These machines have flat frames and spring needles. The leg is knit on a legger, usually of 18 sections, each section knitting one stocking, and the foot on a footer, usually of 20 sections. The fabric is knit flat, varying in width to fit the slopes of the foot and leg. On the top of ladies' stockings is knit a welt. The toe and heel are closed by a looping machine, the sole and back of the leg by a sewing machine. The product is called full-fashioned hosiery.

A circular machine, invented by Decroix, in France, in 1798, did not come into general use. A latch needle was invented in 1847, by Matthew Townsend, of England, who died in America. Many knitting machine inventions have been made by Americans, and this is true especially as to machines for knitting seamless hosiery. Such a machine was patented, in 1860, by William Goddard, of New York; and improved machines, largely automatic, were introduced, in 1889, by Branson & Son, of Philadelphia. Seamless hosiery is produced by latch needles on small, circular machines, which revolve with great rapidity. The finest quality is knit on machines with 21½ needles to the inch, making that many stitches per inch. The ribbed part of half-hose and children's socks, full-fashioned or seamless, is knit on a ribbing machine, and then transferred to the machine which completes the knitting process. Sewing machines close the toe and make the welt of seamless hosiery. With seamless machines hosiery is knit which, shaped to some extent by loose or tight tension, does not conform so closely to the ankle and leg as full-fashioned hosiery, but the cost of production is considerably less. One skilled man and a boy attend two full-fashioning leggers or one footer, while one comparatively unskilled operator attends as many as 15 to 20 machines knitting plain seamless hose for ladies. The quantity produced is much greater per operative on seamless machines than on full-fashioning machines. The operatives in mills manufacturing both hosiery and other knit goods are mostly women; operatives on full-fashioning machines are men exclusively, and on seamless machines women.

Inventions have made seamless machines more and more automatic. By 1910 there were in use machines that had five or six self-acting yarn changes, by which it became possible to insert a finer yarn on the top of the foot, in the instep and on the lower part of the leg than in other portions of the fabric, to insert heavy strong yarn in the toe and heel and to reinforce them, also to make horizontal stripes. With these machines silk or artificial silk can be plaited on cotton, and an anti-run back course knit to prevent raveling from garter tears. By a new invention, the welt is knit on seamless hose; by another, seamless half-hose, including the ribbed part, is knit on one machine; by another, perfectly fashioned seamless hosiery, with closed toe, is knit on a machine, which is neither flat nor circular, but more like the former type; all of these being recent American inventions, which, on account of restricted patent rights, are not yet in general use.

While hosiery manufactured in Europe is nearly all full-fashioned, some circular machines for knitting seamless hosiery were exported from America to European countries before the European War began in 1914, some even to Germany, until then the largest hosiery manufacturing country in the world, and some to Japan and China. While the domestic product is mostly seamless, the desire of well-to-do Americans for the best fitting hosiery has led in recent years to a great increase in the domestic production of the full-fashioned kind, especially in silk. The full-fashioned product has been knit on flat machines of the Cotton type, most of which were imported from Germany, the remainder from England. In 1898 or earlier, however, full-fashioned machines of American invention were used in the United States. Such machines are simpler than those made abroad.

About 1850 the Bailey Company, at Cohoes, N. Y., began to use a power knitting machine for underwear, the first in this country. It was a circular spring-needle machine, and produced flat goods, that is, a flat-effect fabric. About

1858, Cooper & Tiffany patented in the United States a spring-needle machine for making ribbed underwear. By 1882 flat underwear had been largely displaced by ribbed underwear. Before that year ribbed underwear was produced by latch-needle machines of Philadelphia make. Spring-needle machines are used for the finer goods, but with latch-needle machines the production is greater at lower cost. To a small extent full-fashioned underwear is made in this country on flat machines of the Cotton type, but practically all is knit on circular machines that make a tubular fabric, which, when laid out, forms a continuous piece of goods of double thickness. After the fabric is cut into parts for garments, shirt cuffs, drawer bottoms and rib tails, knit on flat or circular ribbing machines, are attached by a looping machine, and the parts are seamed by sewing machines.

Fabrics for knit underwear are now knit flat, ribbed, fleeced, balbriggan or mesh. Ribbed underwear is much more generally used than the other kinds. The fleeced fabric is napped by sharp-pointed needles on a napping machine. Balbriggan is made of hard twisted yarn, of Egyptian cotton in the finer goods, and of yarn stained to resemble Egyptian for cheaper varieties. About 1910 there were important changes in the underwear industry. Many people began to wear underwear knit of cotton instead of wool because they believed the former was sufficient protection against cold and more healthful. For summer wear, mesh fabrics began to supplant balbriggans. Sleeveless shirts and knee-length drawers came into vogue. Union suits began to displace two piece suits. The knit underwear industry was affected also by the introduction of underwear made from woven material.

Statistics of manufacturing industries, collected in 1810, show that the value of hosiery produced then in the United States was $572,742. Hosiery manufacturing then was strictly a household industry, and before 1850 hosiery was chiefly the product of knitting needles plied by hand. Census statistics of the hosiery and other knit goods industries combined, first shown for 1849, appear in the accompanying table.

HOSIERY AND OTHER KNIT GOODS INDUSTRIES IN THE UNITED STATES, 1859–1914.

Source: Census of Manufactures

	1859	1869	1879	1889	1899	1904	1909	1914
Establishments	197	248	398	824	1,006	1,144	1,374	1,622
Value of products	$7,280,606	$18,411,564	$29,613,581	$67,446,788	$95,833,692	$137,076,454	$200,143,527	$258,912,903
Wage-earners	....	14,788	30,699	59,774	83,691	104,092	129,275	150,520
Wages	....	....	....	....	$24,434,497	$31,614,607	$44,740,223	$59,758,151

The production of hosiery and knit goods in 1914 was $258,912,903, in detail as follows: Hose — cotton, $38,390,194; wool, $2,548,047; merino, $1,414,118; silk, $13,851,251; silk-mixed, $6,940,959. Half-hose — cotton, $21,241,280; wool, $1,327,439; merino, $3,384,831; silk, $4,701,969; silk-mixed, $4,298,502. Total hosiery, $98,098,590. Shirts and drawers — cotton, $43,097,937; wool, $3,448,575; merino, $9,228,686; silk, $1,214,609; silk-mixed, $313,439; all other, $219,805. Combination suits — cotton, $25,617,815; wool, $2,490,815; merino, $6,706,102; silk, $886,248; silk-mixed, $393,618; all other, $501,436. Total underwear, $93,119,085. Bathing suits, $2,033,889; gloves and mittens, $10,519,613; hoods, scarfs, etc., $3,456,326; cardigan jackets, sweaters, etc., $26,195,002; all other products, $25,490,398.

Hosiery and other knit goods were manufactured in 34 States in 1914, and the value of the product in New York was $78,299,235; in Pennsylvania, $64,153,449; in Massachusetts, $17,419,077; in Wisconsin, $13,292,305; in North Carolina, Ohio, New Jersey, Tennessee, Illinois, Michigan and Connecticut each, between $9,000,000 and $5,000,000. The population of the United States, excluding outlying possessions, increased 21 per cent between 1900 and 1910, while between 1899 and 1909, the domestic production of hosiery and other knit goods increased in value 108.8 per cent. During the five years from 1909 to 1914, the increase in production exceeded 100 per cent in Tennessee, Minnesota and New Jersey, and was between 50 and 100 per cent in California, North Carolina, Wisconsin, Indiana and Georgia.

All imports of hosiery have been of the full-fashioned kind, and, under the Tariff Act of 1913, as well as under previous acts, most importations have been of the cheaper grades of stockings and of children's socks. The importations of cotton hosiery during the fiscal year ended 30 June 1914 amounted to $2,949,678, or less than 5 per cent of the domestic production in 1914. The imports of underwear have been insignificant as compared with the domestic production; during the fiscal year 1914, the importations of cotton knit underwear amounted to $341,973, or less than half of 1 per cent of the domestic production in 1914. Imports of woolen and silk hosiery and other knit goods have been very small. Before the war began in 1914, American seamless hosiery was exported to the United Kingdom in considerable quantities, to other European countries in smaller quantities, even to Germany, and to Canada, Mexico and South America. The exports of cotton hosiery and other knit goods increased from $1,916,325 in the fiscal year 1909 to $2,546,822 in the fiscal year 1914, or over 150 per cent. Since 1914 exports have increased enormously.

Reports by the undersigned on the hosiery and other knit goods industries, published by the Bureau of Foreign and Domestic Commerce, in 1915, contain a bibliography of both industries.

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HOSIUS (hō'shĭ-ŭs) **OF CORDOVA,** churchman of the 3d century: b. about 257; d. about 358. Sources concerning his life are limited to two letters, one to Emperor Constantine and one to Julius of Rome, and to allusions by contemporaries. He was probably made bishop about 295, holding the office until his death. He held steadfast in his faith and was not shaken by the persecutions under Maximian. It is not certain what part he played at the Synod of Elvira which he attended. For many years, Hosius was the intimate counsellor of Constantine in ecclesiastical matters, and was sent by him to Alexandria in 324 to settle the disagreements between the bishop there and Arius, and also concerning the celebration of the Easter holidays. Subsequently, Hosius attended the Council of Nicæa, at which he exerted great influence, though probably not in any official capacity. There is no doubt that Constantine's signature to the decrees of the council was gained by his religious adviser. The next record of Hosius finds him at the Council of Sardica (343), where, with Athanasius, he formulated the creed of the council. About 10 years later he was invited by the bishops of the court party to join them in condemning Athanasius. This the loyal Hosius refused to do, and accordingly lost prestige in the favor of Constantine. When he refused for the third time to conform to the Arian creed, he was summoned by the emperor to Sirmium, where he was kept practically prisoner for a year, and was finally forced against his will to sign a compromise document formulated by Arian adherents. His signature was widely advertised, and his so-called conversion to Arianism used as a weighty argument by the king's party. After this he was suffered to return to his office at Cordova. His letters are published in Migne, 'Patrologia Latina' (Vol. VIII). Consult Gams, P. B., 'Kirchengeschichte von Spanien' (Vols. II and III, Regensburg 1864–79).

HOSLEY, Harry Hibbard, American naval officer: b. about 1855; d. 1908. Upon graduation from the United States Naval Academy (1875) he entered the government naval service and became lieutenant (1889); lieutenant-commander (1899), and commander (1904). It was under his direction that the great dry dock *Dewey,* weighing some 11,000 tons, was hauled from Chesapeake Bay by way of the Mediterranean Sea, the Suez Canal and the Indian Ocean to Olongapo. The time spent in the journey was but seven months and 15 days, and the distance covered 13,080 miles. Hosley's last years were spent as supervisor of New York Harbor.

HOSMER, hŏz'mėr, **Harriet G.,** American sculptor: b. Watertown, Mass., 9 Oct. 1830; d. 21 Feb. 1908. She became a modeler in clay, and after receiving a general education studied anatomy in a medical college at Saint Louis. Her first work, a reduced copy of Canova's Napoleon, was followed by an ideal head of Hesper (1852). She went to Rome in 1852 and studied under John Gibson, the English sculptor. About this period she produced ideal busts of Daphne and Medusa, and in 1855 completed her first life-size figure, Œnone. To the same year belongs Puck, which gained her a great reputation in the United States, and the next year she executed a Will-o'-the-Wisp. The statue of Beatrice Cenci in the public library of Saint Louis was finished in 1857, and her colossal statue of Zenobia in 1859. Her next work was a statue of Benton, the Missouri statesman, a bronze cast of which was erected in Lafayette Park, Saint Louis. Other works are Sleeping Faun, exhibited at Dublin in 1865 and at Paris in 1867; a statue of the queen of Naples as the Heroine of Gaëta; a monument to Abraham Lincoln; and Waking Faun.

HOSMER, James Kendall, American librarian, biographer and author: b. Northfield, Mass., 29 Jan. 1834. After serving as a Unitarian minister at Deerfield, Mass., 1860–66, and as a private in the Civil War, he was a professor in Antioch College, Ohio, and the University of Missouri, in 1874–92 was professor of English and German literature in Washington University (Saint Louis, Mo.), and in 1892 became librarian of the public library of Minneapolis. Among his works are 'The Color Guard' (1864), a record of experiences as a private in the Civil War; 'The Thinking Bayonet' (1865), a novel; 'History of German Literature' (1879); 'Life of Samuel Adams' (1885); 'Life of Sir Henry Vane' (1888); 'A Short History of Anglo-Saxon Freedom' (1890); 'How Thankful was Bewitched' (1894); a 'Life of Thomas Hutchinson' (1896); 'A Short History of the Mississippi Valley' (1901); 'The Louisiana Purchase' (1902); 'The Civil War in America' (2 vols., (1912); 'The Last Leaf — Observations during 25 Years in America and Europe' (1912). He edited the *Journal of the Lewis and Clark Expedition* (1904) and for the American Historical Association the *Journal of Winthrop Ames* (1908). He was president of the American Library Association 1902–03.

HOSPINIAN, Rudolf, Swiss Reformed writer: b. canton of Zürich 1547; d. Zürich, 11 March 1626. He studied at Marburg and Heidelberg and then returned to Zürich to preach and teach. He was head of the Karolinenschule which was a part of the Great Minster from 1576–95. In the religious controversies of the time he championed the Reformed Church. His principal antagonists were Bellarmine, on the Catholic side, and Hutten on the Lutheran. He was appointed archdeacon of the Great Minster at Zürich in 1588 and pastor of the Fraumünster Church in 1594. His collected works were published by Heideffer (7 vols., Geneva 1681). The most prominent of these was 'Historia Jesuitica' (1619).

HOSPITALS, Field. In the United States army, the director of field hospitals is, like the director of ambulance companies, immediately under the division surgeon and is the latter's executive in respect to the field hospitals of the division. His supervision over the field hospitals is similar to that exercised by the director of ambulance companies over those companies. He ordinarily accompanies the field hospital in advance on the march, remains with it in camp and keeps the division surgeon informed of his movements. He should maintain communication with the director of ambulance companies, to enable that officer to make suitable arrangements for the removal of patients from the front, and with the surgeon in charge of the sanitary column from the advance section to promote the rapid evacuation of patients to the rear.”

The personnel of a field hospital at war strength are ordinarily assigned as follows: 1 major (commanding); 5 captains and lieutenants (1 adjutant and quartermaster, 4 ward surgeons); 3 sergeants first class (1 acting first sergeant in general supervision of the hospital and in charge of medical property and records, 1 in charge of transportation and quartermaster property and records, 1 in charge of mess supplies and cooking); 6 sergeants (1 in charge of the dispensary, 1 in charge of operating equipment, 1 in charge of patients' clothing and effects; 3 in charge of wards); 3 acting cooks; 55 privates first class and privates (46 attendants, 1 dispensary assistant, 1 artificer, 4 orderlies, 3 supernumeraries); and of the quartermaster corps, 1 sergeant (wagon master) and 7 privates (drivers).

The function of the field hospitals is to keep in touch with the combatant organizations and to provide shelter and such care and treatment as are practicable for the sick and wounded of the division who are brought in by the ambulance companies until the sanitary service of the line of communications takes charge of them. A field hospital can meet these requirements only when it is relieved so promptly by the sanitary units in the rear that its mobility is not interfered with. Prompt evacuation of the sick and wounded is necessary also to secure for them the facilities for treatment and the comforts which are available on the line of communications.

On the march and in temporary camps, however, the field hospitals are the nightly collecting points for the divisional sick and injured who are unable to continue the march, and provide for the care of such patients until they can be turned over to the medical service of the line of communications or to a local hospital or hospitals. The use of the field hospitals for this purpose should be carefully regulated by the division surgeon.

For service in combat, the locations of the field hospitals and the number to be opened will be determined by the division surgeon acting under the instruction of the division commander. The director of field hospitals will supervise their opening, giving the necessary orders therefor to the commanders of the field hospitals. He will report their opening to the division surgeon. It is desirable that they be centrally located and beyond the zone of conflict, which will usually necessitate placing them three or four miles in rear of the dressing stations.

On receipt of an order to open a field hospital the following departments are established: Dispensary, kitchen, receiving and forwarding, slightly wounded, seriously wounded, operating room and mortuary. All wounded arriving are received at the receiving and forwarding department, which is the administrative office of the hospital.

When no adequate provision is made for the evacuation of the sick and wounded and a field hospital becomes the nucleus around which a camp hospital is developed, it becomes an immobile unit, and, if the troops to which it is attached should move, another field hospital is required to accompany them. If by reason of retreat or otherwise a field hospital is required to move before it can evacuate its patients, its commanding officer takes action similar to that prescribed for dressing stations in the like contingency.

Field hospital companies form part of the sanitary train and are set up, when conditions so warrant, three or four miles from the battle field. Their position must be one accessible both from the front and rear and where good water is available.

MAJOR EDWARD S. FARROW.

HOSPITALS, History and Construction. History.— Hospitals in the sense of institutions for the care of the ailing poor first occur in history as Christian foundations. Public hospitals are mentioned by no classical writer before the time of Christ, and no trace of one is to be found in the explorations. As Meyer-Steineg points out, Vitruvius, the Greek architectural authority, treats of every kind of public building, but not hospitals. Private hospitals were common enough among the Greeks, and many physicians set aside portions of their buildings for the care of patients. According to ancient Irish traditions (300 B.C.), hospitals of this kind were so common as to be the rule, and there were special Brehon laws regulating their ventilation and other conditions. In India there are some not very definite details with regard to hospitals for men and animals, even before the time of Christ. The only thing resembling our modern hospitals in ancient times were the *valetudinaria* for slaves, and the military lazarettos for wounded soldiers. These latter were supported by government funds. There were a number of health resorts, as at Cos and Epidaurus, but these were for the well-to-do and as in our time, were more frequented by neurotic patients than by the seriously ill.

With the advent of Christianity, there came a new development, and Christ's example in healing the sick made this one of the features of the early history of the Church. Saint Luke was a physician and emphasized this phase of Christ's work in his Gospel. Care for the ailing became a Christian tradition. A portion of the bishop's house in the primitive Church was set aside for the care of those who had no other shelter, and as Harnack notes, at times the bishop was a physician and gave medical attention to the ailing poor in them. Until the end of the persecutions, there could be no public hospitals, but Saint Zoticus is said to have built one at Constantinople during the reign of Constantine. A letter of Julian the Apostate (361) makes it clear that the Christians had many such institutions, for he insists that the old Imperial religion cannot be brought back without charitable institutions similar to those of the Christians, where all, regardless of faith, were cared for. Saint Basil established a hospital at Cæsarea in Cappadocia (369), which shows how seriously the duty of caring for the ill poor was taken. His foundation was outside the city proper and was so extensive that it was called “New Town.” There were structures for different classes of the needy,— for children, for the old, and strangers as well as the ill, besides buildings for physicians and nurses, workshops for what we have learned to call reconstruction work, and even industrial schools and an employment bureau. Basil's example was followed very widely throughout the East. In the West the earliest hospital foundation, according to Saint Jerome, was that of Fabiola at Rome about the end of the 4th century. With it was connected a system of visiting the sick, Fabiola herself organizing it. In the hospital work of Christians there was no distinction of creed, and its open-hearted charity deeply influenced the people of the time.

After this, hospital development continues uninterrupted. The Hôtel Dieu of Paris is said to have been founded in the 7th century, or perhaps the 6th. There is a record of a hospital in Spain at Augusta Emerita (modern Mérida) in 580. This was for the ill, «slave or free, Christian or Jew.» Charlemagne (circa 800) decreed that there should be a hospital in connection with every cathedral and monastery.

During the Crusades, the hospitals of the Hospitallers of Saint John of Jerusalem accomplished an immense amount of good for the very large numbers of the Crusaders at long distances from their homes, in the East. Their hospital in Jerusalem is said to have accommodated 2,000 patients and became so famous for its successful effort to meet every need of the patients that according to an old legend, Saladin, the Sultan of the Saracens, went in disguise to the hospital as a patient to see for himself if it could possibly be true that so much was done for the patients there as he had heard. The hospital of Saint Mary Magdalene in Jerusalem was under the female branch of the Hospitallers which had another large hospital in the Holy Land and a number of branches in various parts of Europe to which the wounded and sick were sent to convalesce. These hospitals became famous for what they accomplished in times of emergency, famine, flood and epidemics, so that the institute would remind one in many ways of the Red Cross in the modern time. After some generations, when the Crusades were drawing to a close, the Hospitallers found it necessary to organize a military branch for the protection of pilgrims and of their convalescent patients on their way home. The word Knights was then added to Hospitallers as their title. This did not occur, however, until nearly a century and a half after they began their work. Both the men and women of the Order wore a rather striking costume with a white cross prominently displayed on the breast of it, so that they must have been conspicuous figures on the battlefield or near it, and there are traditions that both men and women in the Order served close to the lines. There was an immense outpouring of charity everywhere in Christian countries at this time, to enable these Orders to do their work, reminding the modern of our own successful organization of war activities. The resulting good example had much to do with the magnificent development of hospitals throughout Europe which occurred almost immediately after the end of the Crusades. With regard to this movement Virchow calls attention to all that the Popes did for hospital encouragement. He has words of highest praise for Pope Innocent III who did so much for the creation of an extensive hospital system in Christendom. The Pope wishing to have a model hospital in Rome, sent for Guy of Montpellier (circa 1200), who, he was told, had organized the greatest hospital of the time in that city. Guy was commissioned to establish a model hospital in Rome and planned the Santo Spirito in the Borgo not far from the Vatican which existed until our time. The Pope commended this hospital to bishops when they officially visited Rome, and recommended under conditions in which a recommendation was a virtual command, the establishment of similar institutions in their dioceses. As a result, nearly every town of 5,000 inhabitants or more in France, England, Italy, Spain and Germany came to have its public hospital in the course of the next 200 years. Virchow notes over 150 in Germany. Many of these hospitals were beautiful buildings, and not a few of them in the more populous centres were constructed so as to fulfil the most modern requirements. They were as a rule of single story, rather high, with windows well up in the walls to avoid draughts; with galleries for convalescent patients to sit in the sun and for nurses' observation, running along just below the windows; with tiled floors; with a kitchen in a separate building and surrounded by beautiful gardens. The hospital site was often fixed on a stream of water, sometimes an artificial islet being created which insured flowing water all around the hospital, for coolness and refuse disposal. Some of the hospitals in the cities in the Middle Ages were among the most beautiful of their public buildings architecturally and their interiors were decorated by the great painters and sculptors of the time. Some of these in a lofty spirit of charity gave their services for this purpose. Sometimes artists who had been patients painted pictures for the hospitals out of gratitude for their treatment. A noteworthy example is Saint Jean at Bruges, where Memling's paintings visited at a franc per person still give a revenue of thousands of dollars a year. Wards were often built cruciform with an altar at the crossing where Mass was said every morning which provided religious consolation for the patients' thoughts during the day. The windows were often of beautiful stained glass with figures or Bible stories on them which occupied patients' minds.

Hospitals began to run down with the suppression of the religious houses in many countries after the religious revolt in the 16th century. They became state institutions under paid officials and above all women were replaced by men in control of them. The rule of history is that whenever women are not at least coordinate in authority and not mere subordinates in the care of the ailing, the old and children, serious abuses soon creep in. The lowest period of decadence in the history of hospitals came during the later 17th, 18th, and the first half of the 19th century. Jacobsohn, in his 'Essays on the History of Care for the Ailing,' says «it is worthy of remark that attention to the well-being of the sick and improvements in hospitals and institutions generally, had a period of complete and lasting stagnation from the close of the Thirty Years War» (1648). He adds: «The hospitals of cities were like prisons, with bare, undecorated walls and little dark rooms, small windows where no sun could enter, and dismal wards where 50 or 100 patients were crowded together, deprived of all comforts and even of necessaries. In the municipal and state institutions of this period the beautiful gardens, roomy halls and springs of water of the old cloister hospital of the Middle Ages were not heard of, still less the comforts of their friendly interiors.» Garrison in his 'History of Medicine' says that «hospital construction approached perfection in the 15th century, the greatest care being devoted to these structures.» He mentions that there were 27 hospitals in Scotland alone by the end of this century. Hospitals for special purposes had begun to be built before the end of the Middle Ages. The earliest of these were for children and particularly for foundlings, and their organization in the 13th century was very complete. The Ospedale degli Innocenti of Florence is still in existence after seven centuries, doing its work. The colony system for defective children had gradually come into existence several centuries before, at Gheel in Belgium and in certain towns of North France. The first special hospitals for the insane were erected in Spain. Pinel, the great French psychiatrist, who struck the manacles from the insane of France (circa 1795), declared Spain to be the country in which lunatics were treated with the most wisdom and the most humanity. Before the end of the Middle Ages, Bedlam or Bethlehem Hospital in London received the insane, for Tyndale uses the word as meaning a madhouse or a madman. On recovering their reason, patients were allowed to go out of this hospital (the open-door system) wearing a badge to indicate that they had been for some time in the asylum. This index of their previous condition made people so kind to them that special provisions had to be made to keep tramps and other «sturdy vagrants» from wearing these badges and abusing the confidence of the public. The first special hospital for eye diseases in America came about 1820. The first nose and throat hospital in the world was organized in New York about 1870. Orthopedic hospitals for the special treatment of crippled children came about the same time.

The modern hospital revival began well after the middle of the 19th century, and indeed did not make itself felt to any serious extent until after Lister's discoveries led to the development of modern surgery. Three things, good hospitals, good nursing, and good surgery, are inseparably bound together During the period of fine hospital construction in the later Middle Ages, there was an excellent development of surgery and of nursing. Strange as it may seem, for several centuries at this time, serious operations were performed under an anæsthetic and surgeons boasted of getting union by first intention. They used linen soaked in strong wine as primary dressings for their wounds and this acted as an antiseptic. These mediæval surgeons declared that it was not necessary to have pus in wounds, but that on the contrary the presence of pus was an index of negligence of the surgeon. Unfortunately, this teaching went out, to be followed, for some five centuries, by the doctrine of laudable pus. As a result, hospitals became surgically unclean, and infections multiplied to such an extent that surgeons feared to operate. Before Lister's time, a mortality of over 50 per cent of operative cases was not unusual in hospital experience. After Lister, the necessity of absolutely clean hospitals came to be appreciated and hospital construction has been largely influenced by the necessity of avoiding infection to as great an extent as possible. Practically all the developments in hospital building in recent years are made with an eye single to facilitating such care of patients as will prevent their becoming infected or communicating any infection to other patients or leaving anything after them that might prove a source of danger to subsequent inmates.

Construction.— The old-fashioned method of building hospitals came to an end when under the initiative of Dr. John S. Billings, Assistant Surgeon-General and Librarian of the Surgeon General's Library, special studies were made for the erection of the Johns Hopkins Hospital in Baltimore (1875). After this, much less attention was paid to the outside of hospital buildings, and the inside became the subject of intensive study so as to be adapted to various purposes of hospital work. Questions, of ventilation, of floor space and of arrangements for the convenience of patients and physicians, with the proper segregation of infectious cases medical and surgical, and the provision of convenient rooms for laboratories and dietetic equipment, were now the main purpose of hospital architects. A new school of hospital architecture arose and America came to be the centre of world attention in hospital construction. Appropriate rooms were supplied for the hospital resident staff who, as late as the 1860's, were often crowded into a single room, four, six, or even eight together, sometimes with no other place for study or relaxation. This sadly interfered with their work and its usefulness for themselves and the patients. With the coming of the trained nurse, fitting quarters had to be provided for her, and training schools gradually added, because it was found that it was through them that hospitals could best secure this valuable adjunct. Once these principles were clear, the erection of hospitals excellently adapted to the needs of modern medicine and surgery went on apace here in America, until now there are altogether some 5,000 hospitals in the country. Many large industrial corporations have met the problem of caring for the injured among their workmen in special hospitals where the nursing and medical and surgical attention is supplied by the employers. Some not using heavy machinery provide a physician and nurse in attendance during the day in special hospital quarters, because it has been shown that in this way the health of working people, particularly women, can be better conserved and absence due to sickness with consequent reduction in commercial efficiency greatly lessened. These hospital quarters are often built with every modern detail and are models of their kind.

The features of modern hospitals that are most important are the reception rooms and the operating rooms. The reception rooms should provide a special apartment for emergency operating and all the patient's outdoor clothes should be removed there, transferred immediately to a sterilizing room and then placed in lockers to be kept until the patient needs them on exit. Except in emergency surgical cases where there is shock, the patient is thoroughly bathed before being dressed in the regular hospital garments and then transferred to the ward. Private patients are taken directly to their room and cared for on similar principles.

The heart of the modern hospital is the operating room. The supreme idea in the construction of this is cleanliness, though light is a very important secondary consideration. If possible it is built with a northern exposure on the top floor of the hospital both for light and air, as well as that in this situation only those approach it who have business there. It is thus less exposed to the infections that might be brought in from outside. The perfection of artificial light in our day has made the natural lighting problem of ever so much less significance than it was and has facilitated emergency operations at night, even in the receiving ward on the lowest floor, when time is vital. For the sake of surgical cleanliness, the operating room is floored with tile, and the walls for some distance up are made of the same material or of some very hard cement coated with enamel paint that can be thoroughly washed. If there are places for students, these are of limited extent, are made of polished artificial stone or other unabsorbent material with metal railings and usually furnish only standing space. The old surgical amphitheatres built of wood, whose central arenas after a time must have been quite impossible to clean surgically, are a thing of the past. Where they are still used, it is only because of the necessity of teaching large numbers of students and then only for already infected cases. Operating tables have become elaborate apparatus, making it possible to put the patient in any position required, and yet so constructed of polished metal, commonly nickeled, that surgical cleanliness is facilitated.

The operating room is connected with a series of rooms for the sterilization and storage of dressings, for the anæsthetizing of patients, which is no longer done in the operating room as before; for the transfer of soiled dressings, and other such material, so as to be sure that the sterilizing room will be saved from all contact with possibly infected matters, and sometimes with temporary rooms for the treatment of shock after the operation, so that patients may not have to be moved far, nor subjected to the almost inevitable draughts of corridors and elevators during removal after the operation, until the reaction has begun. The improvement of the elevator has greatly facilitated hospital work and the ready removal of patients, making the presence of the operating rooms on the top floor in the warmest part of the hospital possible. Wheel carriages of various kinds add to these facilities so that there is very little of that disturbance in moving patients which was almost inevitable under older conditions.

In the operating room itself, all water connections are so arranged that they can be turned off and on either by the foot or knee, so that there is never any need for the surgeon or his assistants to touch any object with the hand when once cleansed for operations. Instrument cases, if placed in operating rooms, are now made entirely of glass and metal, though preferably there is a special instrument room. Tables on which instruments and dressings are placed are made of metal and glass, the metal usually finished with white enamel paint, easily cleaned, revealing the slightest trace of dirt. As an additional precaution the operating, dressing, and instrument tables are covered with sterilized materials just before the operation. These are changed between all successive operations. All these apparatus are mounted on casters usually of metal or porcelain so as to facilitate necessary movement by simple touch without the necessity of lifting.

The hospital kitchen has grown greatly in importance, and then there are special diet rooms and apparatus for keeping things warm on each floor or with each ward. These are not directly connected with wards, but open out upon the corridor. The development of bathing arrangements in recent years, private baths in connection with many of the private rooms, and a number of baths for ward patients is another important advance of modern times. Corridors of the hospital are usually in slate or tiling with rounded joints to facilitate washing at the angles, though artificial stone floors of various kinds have recently been used for this. These are hard on the feet of nurses, hence the use of compressed cork which is now coming in.

Ventilation is one of the most important requirements for good hospital work. To secure this, patients must have a definite amount of air space. It has been decided by experts that the minimum square feet of floor space and of cubic feet of air for each patient must, according to age, be in accordance with the following table:

MINIMUM SQUARE FEET OF FLOOR SPACE.

	Adults	Children	Babies
In private rooms	90	75	55
In wards	80	65	45

MINIMUM CUBIC FEET OF AIR SPACE.

	Adults	Children	Babies
In private rooms	900	675	500
In wards	800	600	400

Experience has shown that in wards there should be at least eight feet from centre to centre of beds. If there are two rows of beds in the ward, then the ward must be at least 24 feet wide, for the beds should not be placed nearer than 1½ feet from the wall. The beds themselves should be 6½ feet long, with 8 feet of corridor space between them.

Another feature of the modern hospital in which there has been reversion to old time hospitals is in the arrangement of the gardens. Mediæval hospitals usually had pretty gardens around them which made pleasant vistas from the doorways and windows and restful resorts for convalescent patients. Landscape architects are now asked to design hospital gardens and some of these are very beautiful. Such pleasant surroundings are considered a very important addition to other modes of therapeutics affecting patients' minds very favorably.

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JAMES J. WALSH, M.D.

HOSPITALS, Military. Military hospitals were organized under the Greeks and Romans but only for their own soldiers. Enemy wounded were neglected, often even deliberately maltreated, sometimes massacred. They often became slaves upon recovery. With Christianity, better conditions prevailed but war always lessened the feelings of humanity. Queen Isabella of Spain is one of the first in history to have insisted that enemy wounded must be cared for like her own soldiers. She organized camp hospitals first in modern time. Early in the 16th century, Camillus of Lellis founded an association for the care of wounded on the battlefield, which wore as a symbol of its special mission a red cross. Later he founded a religious order whose aim was the care of the wounded in battle, and also the plague stricken and others in need at critical times and who visited the sick in their homes. All this pioneer work in the organization of care for wounded soldiers had been lost with the descent of hospitals and nursing which reached its lowest ebb in the mid-19th century. The awful neglect of the wounded in the Crimea (1854) led to Florence Nightingale's work and the reform of hospitals generally. Modern military hospitals have the advantage even when in but temporary quarters, of recent progress in hospital construction and organization. When they are single story barracks, they are thoroughly clean, with abundance of light and air and careful arrangements to prevent contamination of the quarters. The operating room is the heart of the military, as of the civil hospital and is thoroughly equipped. Floors are made of matched boards if not of cement or tile and an abundance of water used for cleansing. Separate rooms for anæsthesia, for sterilizing, for the disposal of septic materials, are provided, so there is as little likelihood of infection within the hospital, as in any good city hospital.

Special care is taken that the hospital shall be free from the visits of flies and in malarial and yellow fever regions, of mosquitos and that the body vermin shall be destroyed without any possibility of transfer to others. These little pests as they were considered, have been proved to be the distributors of disease which caused more deaths than the bullets of the enemy. The situation of the hospital then is usually such that it is out of direct contact with the camp, and separate buildings are provided for infections of various kinds. Excreta and all absorbent materials that had been in contact with infectious cases are incinerated, special provision being made for this. Proper cleanliness requires a large supply of water, nearly 10 gallons a day, for each man. Anything less than 10,000 gallons for 1,500 men is too small an amount. Probably the most important factor for the saving of human life in modern hospitals has been the introduction of the trained nurse since Miss Nightingale's time. Good nursing, that is faithful care and skilled observation, so that any threatened symptoms will be noted at once, regular, appropriate meals, and thorough personal cleanliness of the patient account quite as much as the modern expert surgical treatment for the lessened mortality of wounded soldiers in war.

In times of peace or in territory not the scene of active military operations hospitals are established at the various camps or posts under the charge of the senior medical officer of the camp or post to take care of the sick. For the care of the more serious, complicated or obscure cases department and general hospitals are organized. General hospitals are under the exclusive control of the surgeon-general except as to matters which concern the administration of military justice. They are staffed by officers of the medical and dental corps, men of the hospital and quartermaster corps, nurses belonging to the army nurse corps, and civilian employees. Permanent general hospitals are established at Hot Springs, Ark., for the treatment of such diseases as are benefited by the waters there, and at Fort Bayard, N. M., for the treatment of pulmonary tuberculosis. Additional general hospitals may be established by the surgeon-general in wartime at such places as he considers most suitable. At points of embarkation where there are no general hospitals, port of embarkation hospitals may be established under the surgeon of the port of embarkation. Special general hospitals may also be organized for the care of prisoners of war.

In time of war and in the zone of operations, the field hospital is that unit of the medical service known by the name of hospital which is nearest the front. Its personnel consists of 1 major in command, 5 junior officers, 3 sergeants, first-class, 6 sergeants, 3 acting cooks and 55 privates or privates, first-class, in addition to 1 sergeant and 7 privates of the quartermaster corps. Its function is to shelter and care for the wounded and sick as they are brought in from the firing line until the sanitary service of the communications can remove them. Field hospitals are attached to divisions, and are used on the march or in temporary camps for the care of the divisional sick or injured until they can be sent to local hospitals or to the rear. In action, the divisional surgeon determines the position of the field hospitals, paying due attention to securing for them a central position, easily accessible, with good water, and if possible with suitable buildings. The field hospitals are opened by order of the division surgeon to the director of field hospitals on his staff as soon as the number of wounded justifies it. Patients are sent as soon as possible from the field hospitals to the evacuation hospitals (two to a division) on the line of communications. The evacuation hospital is manned by a lieutenant-colonel, a major, 14 captains and lieutenants, 8 sergeants, first-class, 20 sergeants, 10 acting cooks and 141 privates first-class and privates. The evacuation hospital replaces the field hospitals and allows them to move on with their divisions. Like a field hospital, an evacuation hospital continually sends to the rear all who can be moved.

They are received by the base hospitals, which are located in buildings, if possible, at the base of the line of communications. They are under the charge of the surgeon of the base group on the line of communications. The establishment of a base hospital consists of a colonel, a major, 18 junior officers, a dental surgeon, 8 sergeants, first-class, 16 sergeants, 14 acting cooks, 115 privates, first-class, and privates, and 46 female nurses. The base hospital is the place where definitive treatment is given to the men from the field and evacuation hospitals. They only send home those who are permanently disabled and those whose recovery will consume a long time, unless their capacity is exceeded. Special hospitals may be formed for other causes, as for contagious diseases. Military hospital organization in foreign countries follow the principles here outlined, though differing somewhat in details. Consult the 'Manual for the Medical Department, United States Army' (Washington 1916); and the corresponding publications of foreign governments. See Ambulance Companies; Army Organization; Hospital Corps; Hospital Ships; Hospital Trains; Red Cross.

James J. Walsh, M.D.

HOSPITAL, Psychopathic. Psychopathic hospitals (psychiatric clinics, psychiatric institutes) are institutions for the specialized care and investigation of mental disease. They represent the application of general hospital ideals and investigative standards to the problems of disorders of mind. They are institutions for the first care and observation of mental cases, for treatment of the acute and curable cases, for special investigation into the causes, types and treatment of the mentally disordered, for the study of cases in which nervous or mental disease or defect is suspected to be the cause of conduct disorder, and for the instruction of students and physicians.

There are about 60 such institutions in the world, over half of them in German-speaking countries. Some have grown out of general medical clinics, many (especially in Prussia) from the necessities of teaching in insane hospitals, others as specialized institutions, because of elevating the standards of care and study of the insane. Eight such clinics were established in Germany from 1866 to 1882. The first specially constructed institute was that at Halle, opened in 1891 under the direction of Hitzig, who was famous for the discovery of the electrical stimulability of the brain cortex. At the present time there are some 25 such clinics in Germany with capacities from 60 to 300 beds.

Institutes of a somewhat similar type have been opened in practically all the European countries and in Japan. Some of them are administered as departments of general hospitals, others are related to insane hospitals.

There are six institutions of this general type in the United States. The Psychiatric (originally Pathological) Institute of the New York State Commission on Insanity was reorganized with clinical as well as pathological aims in 1902, under Dr. Adolf Meyer. This is almost purely a research and instruction institute, since the patients are derived from among those sent to the Manhattan State Hospital where the institute occupies quarters. Cases which the institute desires to study are sent to special wards.

The Albany, N. Y., General Hospital opened a ward called Pavilion F, for the observation and treatment of mental cases in 1902. In the same year the Bellevue and Allied Hospitals were established in New York and the psychopathic service was augmented. This service now deals with a great number of patients in the course of a year, chiefly as an observation or detention ward prior to commitment.

In 1906, the State Psychopathic Hospital at the University of Michigan, Ann Arbor, was opened with Dr. A. M. Barrett as director. This hospital comes very close to the European ideal but its bed capacity is somewhat limited and there are certain restrictions on the voluntary admission law which interfere to some extent with its work.

In 1913, the Phipps Psychiatric Clinic at Johns Hopkins University in Baltimore, Md., was opened under the direction of Prof. Adolf Meyer. It approximates closely the ideals of the foreign clinics.

In 1912, the Psychopathic Department of the Boston State Hospital, or as it is commonly called, the Boston Psychopathic Hospital, was opened under the direction of Prof. E. E. Southard, and maintains an active clinical service as well as pathological service for the State Commission on Mental Diseases.

Such institutions are important forces in the modern movement for mental hygiene. They are valuable centres for the mental health of the community. They represent the application of the highest standards to the problems of mental disease and such an institution should be provided for every large city.

Lawson G. Lowrey, M.D.

HOSPITAL CORPS, United States Army, a branch of the United States Military Medical Service, established by the act of 1 March 1887. It consists of sergeants, first class, sergeants, corporals, acting cooks, privates, first class, and privates, and has as its function the performance of all necessary hospital services in camp, garrison and field, including ambulance service. Sergeants, first class, and sergeants are appointed by the Secretary of War upon passing an examination prescribed by the surgeon-general. Acting cooks are promoted by an officer commanding any hospital or sanitary formation from among the privates and privates, first class, employed therein. Enlistments are made by medical officers by the authority of the surgeon-general or department surgeon. Men may also be transferred from other branches of military service. See Ambulance Companies; Army Medical Corps; Hospital, Military.

HOSPITAL CORPS, United States Navy, a branch of the United States navy under the control of the Bureau of Medicine and Surgery which has the duty of performing all necessary medical and hospital service at naval hospitals, naval stations, navy yards and marine barracks, and on vessels of the navy, coast survey and fish commission. It was established by the act of 17 June 1898. It contains chief pharmacists (commissioned warrant officers), pharmacists (warrant officers), hospital stewards (chief petty officers), hospital apprentices, first class (petty officers, third class),

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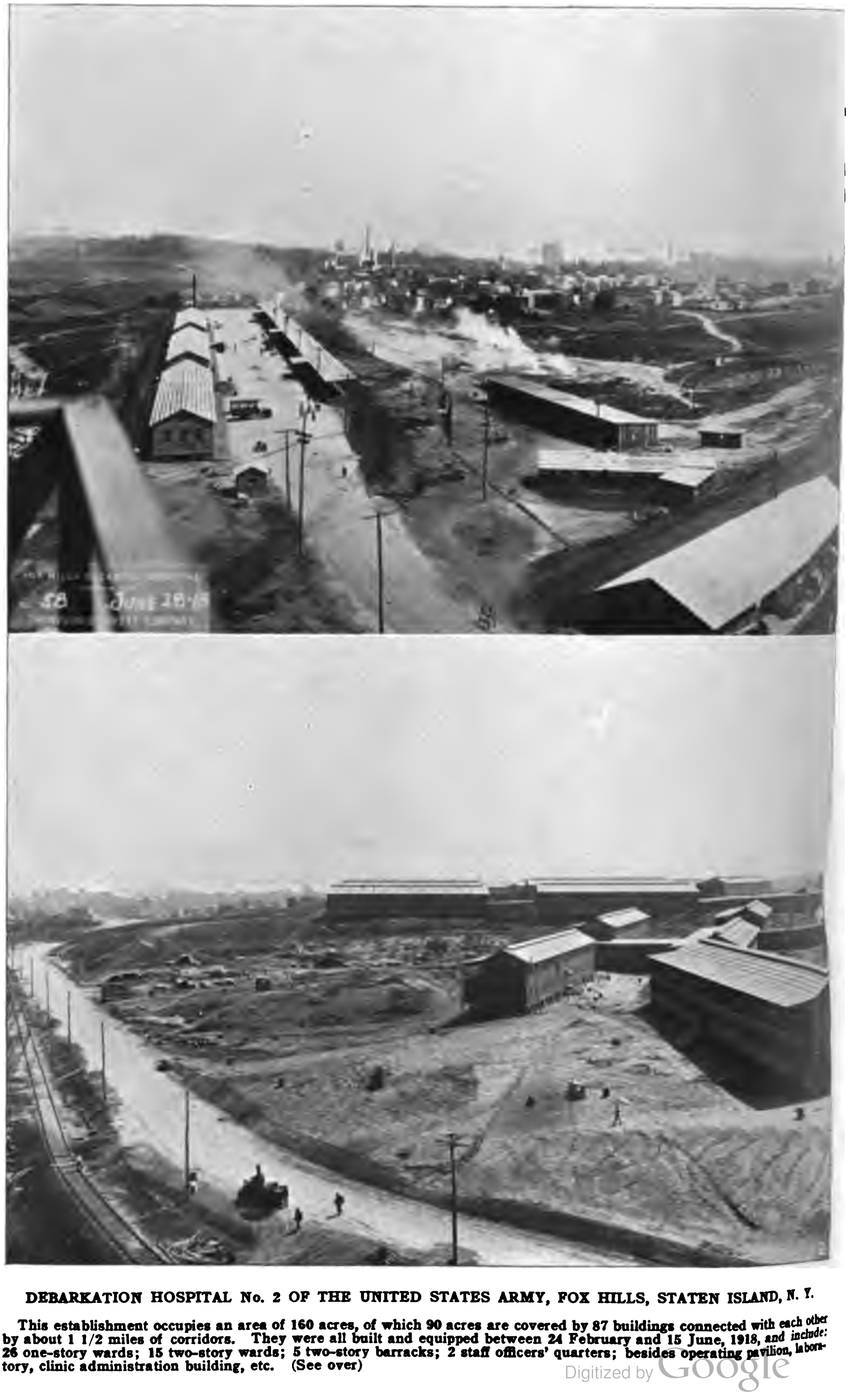
DEBARKATION HOSPITAL No. 2 OF THE UNITED STATES ARMY, FOX HILLS, STATEN ISLAND, N. Y.

For this establishment 6,600 feet of standard gauge railroad track, 10,027 linear feet of macadam and 15,840 feet of cinder roads were constructed in the grounds, and elaborate water, sewer, steam heating, electric light and power systems were installed, making it one of the largest and most complete military hospitals in the world



DEBARKATION HOSPITAL No. 2 OF THE UNITED STATES ARMY, FOX HILLS, STATEN ISLAND, N. Y.

This establishment occupies an area of 160 acres, of which 90 acres are covered by 87 buildings connected with each other by about 1 1/2 miles of corridors. They were all built and equipped between 24 February and 15 June, 1918, and include: 26 one-story wards; 15 two-story wards; 5 two-story barracks; 2 staff officers' quarters; besides operating pavilion, laboratory, clinic administration building, etc. (See over) and hospital apprentices (seamen, second class). All enlistments except for the rate of hospital apprentice must be addressed to the surgeon-general. Hospital apprentices may be examined and enlisted at any navy yard or recruiting station. Men in other branches of navy or marine corps service are eligible for transfer to the hospital corps. All promotions are made by examination, and the total number of pharmacists and chief pharmacists together is limited to 25. The hospital corps men on board ship form what is known as the surgeon's division. Schools for hospital corps men are maintained at the training stations at Newport, R. I., and San Francisco, Cal.

HOSPITAL SHIPS. By the regulations for the government of the navy of the United States, ships may be designated by the Navy Department as hospital ships. In all matters concerning their use as hospitals, they are assimilated to hospitals on shore, and are under the control of the Bureau of Medicine and Surgery of the United States navy. They are commanded by naval medical officers not below the rank of surgeon. The commander has under him a merchant crew and officers, for the purpose of navigation, and a detail from the hospital corps of the navy, together with such female nurses and junior medical officers as may be required. The ship is considered to be a naval auxiliary, and in all non-medical matters is subject to the inspection, care and supervision of the supervisor of medical auxiliaries. The merchant crew is under the command of its master, who is in full control of its discipline and the navigation of the ship. Hospital ships are for the sole purpose of the care of the sick and wounded of the navy, marine corps and army, and of the shipwrecked or other persons needing medical assistance. They are forbidden to carry any officers or men not sick, disabled or shipwrecked besides their complement, or any contraband of war except the coal and stores needed for upkeep and movement. Strict neutrality is enjoined on all hospital ships, and they carry no guns or ammunition not necessary for the protection of the sick and wounded and the maintenance of order on board. Naval hospital ships fly the Geneva cross at the main instead of the narrow pennant and are painted white, with a horizontal band of green a meter and a half wide. In 1916 the only naval hospital ship of the United States was the *Solace*, of 5,700 tons, with a complement of 59 hospital corps men and 100 in the merchant crew. It was used for hospital purpose with the fleet in time of peace. The army also provides on oversea expeditions hospital ships which are manned by the medical department as far as their medical aspect is concerned, and ships for patients, which are ordinary transports or merchant vessels put into temporary medical use. The medical complement of a hospital ship of 200 beds consists of 1 lieutenant-colonel or major; 4 junior officers; 1 sergeant, first class; 4 sergeants; 5 acting cooks; 30 privates, first class, and privates. When hospital ships are furnished by the American Red Cross, they are likewise commanded by army medical officers. Hospital ships are also used for the conveyance of medical department personnel and supplies.

The second Geneva Convention of 1868 provided that hospital ships, merchantmen having wounded on board and boats picking up the wounded or shipwrecked should be neutral and immune from attack or capture. They are painted in the manner which has been described for the United States navy if they belong to a government, and with a similar red stripe if they belong to an aid society. They fly the Red Cross flag besides the national ensign, and are not allowed to carry arms. They lose their rights to neutrality if they are used for other than strictly medical purposes.

Civilian hospital ships may be classed under two heads: those that work among the merchant fleet; and those that work primarily among the children of the great cities, giving them the benefit of sea air and a respite from the summer heat during their sickness. The United States coast-guard cutter *Androscoggin* has been fitted out as a hospital ship under a surgeon of the public health service for service among the fishing fleet of the north Atlantic, and the same sort of duty was done by a French ship, the *Saint François d'Assise*. Of the second class, the Boston Floating Hospital and the hospital ship maintained by the Bellevue Hospital of New York city are good examples. The latter ship is used primarily for tuberculous cases, and is in commission throughout the year. See ARMY MEDICAL CORPS; GENEVA CONVENTIONS; HOSPITAL CORPS, UNITED STATES ARMY; HOSPITAL CORPS, UNITED STATES NAVY; RED CROSS SOCIETIES; WAR, EUROPEAN.

HOSPITAL TRAINS. See HOSPITALS, MILITARY.

HOSPITALLERS, mediæval charitable brotherhoods whose members devoted themselves to tending the sick in hospitals. The name was specially applied to an order of the Knights of Saint John. See ORDERS, RELIGIOUS.

HOSPODAR, hŏs'pō-där, a title formerly worn by the governors of Moldavia and Wallachia, signifying, in its simplest derivation, «master.» The title was also applied to the princes of Lithuania and Poland, and to the emperor of Russia.

HOSS, Elijah Embree, American Methodist Episcopal bishop of the South: b. Washington County, Tenn., 14 April 1849. He was graduated at Emory and Henry College, Virginia, and was ordained in the ministry of the Methodist Episcopal Church South in 1870. He was incumbent of the pastorates at Knoxville, Tenn., San Francisco and Asheville, N. C., successively. From 1876–81 he was president and professor at Martha Washington College, Abingdon, Va., and was connected with Emory and Henry College from 1881–85, first as vice-president and then as president. He was professor of ecclesiastical history at Vanderbilt University from 1885–90, and editor of the *Nashville Christian Advocate* (1890–1902). Since May 1902, he has been a bishop, with residence at Muskogee, Okla.

HOST, or HOSTA SACRA (sacred host), in the liturgy of the Catholic Church, the body of Christ present in the sacrifice of the Mass under the appearance of bread (see EUCHARIST; TRANSUBSTANTIATION). The Latin word *hostia* denotes that which is offered in sacrifice; hence in the Mass, where the victim is the same who offered himself on the cross, «the cup» is no less the *hostia* than is «the bread»; but usage has sanctioned the appropriation of the word host to the latter. In the canon of the Mass, the priest, in offering the consecrated elements to God the Father, speaks of both the «bread» and the «cup» as *hostia;* and in the ancient Spanish missal (the Mozarabic) occurs the phrase «this host of bread and wine.» But the word *hostia* is also employed to signify specially the bread before consecration; and this usage has its sanction in the Roman liturgy itself and in the rubrics of the Missale Romanum. In the rubric of the *ordo missæ* the altar-bread before consecration is called *hostia,* and after consecration it is called *hostia consecrata.* «Host» in the former sense, that is, the «altar-bread,» is, in the Latin Church, a circular wafer made of fine wheaten flour mixed with water only, and it is unleavened. Usually the wafers are stamped either with an image of Christ crucified or with the letters I H S. They are of two sizes, a larger one which the celebrant himself receives (a host of this size is also reserved for the benediction of the Blessed Sacrament); and a smaller size for administration to those who may communicate at the Mass, or to the sick in their houses. The hosts destined for this use are kept in the pyx (called also *ciborium*), a silver vase gilt inside, and deposited in the tabernacle of the altar. As long as the host is thus reserved in the tabernacle the sanctuary lamp is kept alight before it. The Eastern churches in communion with the see of Rome, except the Maronite and Armenian churches, retain the use of leavened bread in the Eucharist.

HOST, a term in pathology, chiefly in plant pathology, designating the organism upon which a parasite is living. In the case of galls, for example, the plant is the host for the parasite (q.v.).

HOSTAGE (French, *ôtage;* Latin, *obses;* Low Latin, *obstagius*), a person or sometimes a thing left as pledge or surety for the performance of the articles or conditions of a treaty. The taking or giving of hostages is now scarcely known in the relations of modern communities, but was formerly almost universal, and many questions in the law of nations arose out of the practice. Writers on international law have discussed how far the rights of conquerors extend over hostages, what circumstances may release them from their obligation and what effect their escape will produce on the treaty proposed by the contracting parties. In modern warfare hostages are not usually interchanged.

HOSTELRY. See HOTEL.

HOSTIUS, hŏs'tĭ-ŭs, a Roman epic poet of the 2d century B.C. All that is known concerning his works is that he wrote metrical annals in imitation of Ennius and a poem, 'Bellum Histricum,' on the Istrian War (129 B.C.), celebrating the victory of the consul Gaius Sempronius Tuditanus. The fragments of this work are preserved in Baehrens, 'Fragmentæ Poetarum Romanorum' (1886).

HOSTRUP, hŏs'trŭp, **Jens Christian,** Danish poet and dramatist: b. Copenhagen 1818; d. 1892. He studied at the university in his native city, where he produced a play which was successfully presented by his fellow students, under the title 'Gjenboerne' ('Neighbors,' 1843). He wrote, under the pen name of «Kristrup,» numerous plays of a strongly national character, including 'Intrigerne' (1848); 'En Spurv i Tranedands' (1846); 'Eventyr paa Fodreisen' (1850); 'Soldatlöjer' (1849); 'En Nat Mellen Fjeldene' (1852); 'Mester og Lærling.' In 1855 he entered the priesthood and occupied himself with parochial duties. His later works include a series of popular lectures, 'Folkelige Foredrag' (1882); a volume of poems, 'Sange og Digte' (1884); a drama, 'Eva' (1881). A collection of his poems appeared in six volumes (1852–56), and of his comedies, in 1888–89. Consult Klint, 'Jens Christian Hostrup' (Copenhagen 1893).

HOT AIR ENGINE. See ENGINE.

HOT-BED. See HORTICULTURE.

HOT SPRINGS. See SPRINGS.

HOT SPRINGS, Alaska, a town on Baker Creek, near the mouth of the Tanana River. On account of its hot springs it is a popular health resort. Truck-farming is extensively carried on. The mines of the district are well known. Pop. about 125.

HOT SPRINGS, Ark., city and county-seat of Garland County, and one of the most famous sanatoriums of the United States, in the southeastern centre of the State, 55 miles southwest of Little Rock and 397 miles from Saint Louis, on the Saint Louis, Iron Mountain and Southern, the Chicago, Rock Island and Pacific and other railroads. The location is 600 feet above sea-level and lies principally at the easterly base of the mountain complex known as the Ouachita Range, the nearby peaks of which are ofttimes called the Ozark Range — in a valley between two rocky and heavily wooded ridges called West Mountain and Hot Springs Mountain, 400 feet higher — and in its sheltered situation has a mild and pleasant climate. Lat. 34° N. long. 93° W. Through the valley runs the Hot Springs Creek, starting two miles above; and into this the water from 47 hot mineral springs — originally 73, but many merged artificially or run dry — springing from vents in the gray volcanic tufa near the base of the Hot Springs Mountain on the east. Forty-four are in use or usable; the others rise in the bed of the creek. The former yield 830,000 gallons a day, contain large amounts of calcium and magnesium carbonates, and the presence of lithium, iodides and bromides, etc.; the total mineral matter in solution is between 275 and 280 parts per million and the results, as to the percentage composition of the mineral matter in each hot spring, are very much the same. The waters are prescribed for bathing and drinking and have remarkable curative properties. De Soto, it is said, sought to explore them as the veritable fountain of youth. As many as 150,000 patients and pleasure seekers visit the place annually. The temperature of the springs varies from 97° to 147°. All issue from a space something over a quarter of a mile long and from 200 to 300 feet up the slope, some 10 acres in all. By treaty with the Quapaw Indians in 1818 and by act of Congress in 1832, four sections (2,529 acres) became a reservation, and the springs are in the centre. Dunbar and Hunter of the Lewis and Clark expedition visited the place in 1804 and settlement was made in 1807. After 1832 numerous attempts were made to enter the lands and title to property involved many years of contention and "shotgun right." In 1870 Congress authorized suits against the United States in the Court of Claims. In 1876 title was held to be in the United States by the Supreme Court. Justice Field of the Supreme Court in an opinion said: "From the protracted litigation to which it has given rise the Hot Springs Reservation is famous in the history of land titles of the country." And Justice Bradley: "The title to a well-known watering place in the State of Arkansas, called the Hot Springs, has been contested by a number of claimants for nearly half a century." In 1877 Congress created a commission to adjudicate squatter rights, giving right of purchase from the United States and to lay off the town. Under this act the Hot Springs were reserved by the United States to prevent monopoly or injury, and 911 acres are used as permanent parks. The government has expended vast sums in arching the creek, erecting the Army and Navy Hospital (open to soldiers and sailors of the Civil War) and in developing and beautifying a system of parks not yet finished. These parks are covered with forest trees and some are thoroughly fitted up for public enjoyment. Large sums have been spent on boulevards, walks, artificial lakes, landscape gardening and handsome marble hot-water fountains scattered plentifully through the city. The grand entrance to Hot Springs Mountain, from Central avenue, is a noble architectural feature, and the initial point of 15 miles of fine drives around the summits of Hot Springs, North and West Mountains.

With one exception the springs are all enclosed in solid masonry, and the water is conducted by protected pipes into reservoirs near the base of Hot Springs Mountain or to the 23 bathhouses on and off this reservation. The exception is left open and accessible to the public. The government maintains a free bathing establishment for the indigent, at which over 10,000 bathe annually, over 90 per cent being benefited. The prices of baths and fees of attendants are fixed by the Department of the Interior, with severe penalties for deviation. A handsome city has grown up to house the guests and permanent residents. On the slope of Hot Springs Mountain is a fine park of 100 acres, with the most elegant buildings facing it. The creek is covered in and sidewalks and roadways built over it. Several hotels, as the Arlington, Eastman, Majestic, Como, are among the largest and best appointed in the country. The city has a fine courthouse, city hall and opera house. One of the features of the place is the tower on the summit of the mountain, from which four States can be seen and one of the best 18-hole golf courses in the South.

Hot Springs received its city charter in 1879. The city has a mayor and four commissioners, who employ a city manager. Being a pleasure resort, as well as a health resort, it has a large itinerant population. Large quantities of novaculite rock, "Arkansas" and "Ouachita" are quarried in the surrounding mountains, and 5,000 bales of cotton are marketed annually. The country abounds in cold springs, some of which have remarkable curative properties, notably Mountain Valley and Potash-Sulphur, 10 and 17 miles distant from Hot Springs; these are efficacious in conditions affecting the kidneys and intestinal tract. Pop. 17,238.

George R. Belding,
Secretary Business Men's League.

HOT SPRINGS, N. C., a town in Madison County, on the French Broad River, 38 miles northwest of Asheville. The Southern Railway serves the town. It is particularly known as a health resort because of its hot springs and its elevation. Lumbering and mining are the chief industries. Dorland Institute is located here, a mission school for mountaineers. Pop. 450.

HOT SPRINGS, S. D., city, county-seat of Fall River County, on Fall River, the Fremont, E. & M. V. and the B. & M. railroads, about 100 miles south of Deadwood. It is the trade centre for stock, lumber and mining interests. The water power is used for several manufactories, a stucco-mill, board and planing-mills and machine shops. It has thermal and medicinal springs and is the seat of the Black Hills College (M. E.), opened in 1890, the State Soldiers' Home and the National Battle Mountain Sanitarium, erected at a cost of $2,000,000. Pop. 2,140.

HOT SPRINGS, Va., health resort in Bath County, about 75 miles north of Roanoke, on the Chesapeake and Ohio Railroad. The first settlement in this region was made about 1740. The mineral springs attract numerous visitors, for whose accommodation Hot Springs supplies a number of fine hotels, the most noted of which is the old Homestead Hotel. There is also a fine public library. Pop. 500.

HOT SPRINGS RESERVATION, or **HOT SPRINGS NATIONAL PARK,** Arkansas, the oldest of the 16 national parks of the United States. It now contains an area of 911 acres near the centre of Arkansas, and is visited annually by 125,000 or more persons who are attracted by the fame of the radioactive waters. The authentic history of this place begins with 1804, in which year Dunbar and Hunter of the Lewis and Clark expedition visited the springs, as their report shows. A cabin was built here by Manuel Prudhomme in 1807, and he was joined in the same year by John Purciful and Isaac Cates, who engaged in hunting and trapping. Toward the end of the 20's there were permanent residents; and in 1832 four sections of land were reserved by the government, with the hot springs near the centre. In 1878, however, this land was sold to various claimants, with the exception of that portion which now forms the Hot Springs Reservation, consisting of five units, namely, Hot Springs Mountain, Whittington Lake Reserve Park, and the North, West and Sugar Loaf mountains. The hot water springs issue forth only from the west slope and at the base of Hot Springs Mountain, which embraces 264 acres; the 46 springs, with an average daily flow of 826,000 gallons and an average temperature of 135° F., are confined within an area of 500 by 1,400 feet. The superintendent writes, in his report to the Secretary of the Interior for the fiscal year ended 30 June 1915, that "the trust reposed in the government by the people has been guarded with extreme care. The springs are now the property of the people, free from monopoly and extortion, and within the reach of all.» But in the same year the government was urged — and with good reason — to provide for the erection of a new public bath. Mark Daniels, the general superintendent and landscape engineer, wrote: «Hundreds of thousands of people have been relieved of suffering and as many have had their lives saved by virtue of the medicinal qualities of the waters of Arkansas. It is a great institution and one that fully warrants the hearty support of our Federal government. The bathhouses that are privately owned are many of them luxuriously appointed, and the growing contrast between the people who have money and can afford these bathhouses and the conditions with which the poor are confronted in the free bathhouse is one that arouses righteous anger.» Dr. Bertram B. Boltwood, of Yale University, authorized to report to the Secretary of the Interior on the radioactivity of the waters, stated that he reached the following conclusions: 1. The waters of the springs on the Hot Springs Reservation are all radioactive to a marked degree. 2. The radioactivity of the waters is due to dissolved radium emanation (a gas), and not to the presence of salts of radium or other radioactive solids.

The Department of the Interior exercises no direct control or supervision over any matters connected with the city of Hot Springs, which is a municipality (pop. about 16,000) governed under State laws. Adjoining the reservation and well supplied with all modern facilities (hotels, furnished apartments and cottages, etc.), it is built at an elevation of 600 feet above sea-level and the climate is good the year round. It is the county-seat of Garland County, 54 miles from Little Rock, on the Saint Louis, Iron Mountain and Southern, the Chicago, Rock Island and Pacific and the Memphis, Dallas and Gulf railways. See NATIONAL PARKS AND MONUMENTS.

HOT SULPHUR SPRINGS, Colo., borough, chief town and county-seat of Grand County, on the Grand River, near the north-central part of the State, and on the Denver and Salt Lake Railroad, about 65 miles from the Wyoming boundary line and 110 miles northwest of Denver. It was settled in 1873 by W. N. Byers and family, and was incorporated in 1903. It is in a high valley surrounded by mountains. The famous «hot springs» of Grand County are here. The water is highly impregnated with sulphur, and issues from about 25 distinct openings at temperatures of from 110° to 117° F. Many tourists visit the place annually on account of the sublime scenery, climate and the medicinal properties of the springs. Elevation, 7,600 feet. The adjacent valleys furnish pasturage for large herds of cattle. The principal public buildings are the county courthouse, the Congregational church and the public school. There is one bank with a capital of $5,000; the annual amount of business is $250,000. The government is vested in a mayor and a council of six members, three of whom are elected each April. Population, 450.

HOTCHKISS, Benjamin Berkely, American inventor: b. Watertown, Conn., 1 Oct. 1826; d. Paris, France, 14 Feb. 1885. He was in early life a machinist and turned his attention to the invention of deadly weapons, among them the Hotchkiss magazine gun and the Hotchkiss machine gun, adapted for use in the fighting-tops of warships. In 1870 he established a factory at Paris. His guns were widely used by navies and armies until supplanted by other devices. He also improved heavy ordnance and projectiles.

HOTCHPOT, a legal term for the bringing together of the advancements made to children during the life of a parent and the joining of these advancements with the property left at death. This is done in order that the whole may be equally divided among the children. Blackstone explains the term as follows: «Hotchpot is, in English, a pudding; for in a pudding is not commonly put one thing alone, but one thing with other things.» The various States of the United States have enacted laws to cover the provisions of this old English law, the object of which was to provide equality among the children of deceased persons. This law, however, generally only provides for the return of advances and not of gifts. See COLLATION.

HOTEL, or HOSTELRY, an inn or public tavern. The palatial hotels that have sprung up since the introduction of railways are too well known to require notice. One point of difference between the European and the American systems is that under the former the charge is for lodging only, while under the American plan it includes both lodging and meals. In former years many American hotels were run on the American plan. In modern times their number has greatly decreased, and they are restricted almost entirely to smaller cities and towns. The modern French word is still used for the house of a rich or distinguished man, or for a public building, such as the *Hôtel de Ville,* the French term for city hall. Recent developments of hotels have resulted in the building of hotels for many special purposes, such as hotels for women, workingmen, girls, boys, etc. An extensive literature on the subject of hotels, their architecture, equipment, management, etc., has sprung into being, much of it in the form of special articles in architectural and other class journals. The hotel business itself has its own circle of trade journals of which numerous are published in every civilized country, amongst which are dailies, weeklies and monthlies. Consult Beal, J. H., 'The Law of Innkeepers and Hotels, etc.' (Boston 1906); Guyer, E., 'Das Hotelwesen der Gegenwart' (Zürich 1874); McGovern, J., 'Hospitality; Mine Host from the Time of Babylon to the Age of the Aeroplane' (Chicago 1910); Michel, F., and Fournier. E., 'Histoire des Hôtelleries, etc.' (Paris 1851).

HÔTEL-DIEU, dyę, the name of the principal hospital in most French towns. The Hôtel-Dieu at Paris is one of the oldest in Europe and is said to have been established in 660 A.D. In 1772 it was destroyed and shortly after rebuilt on the same place. In 1868 it was moved from its old location on the south side of the Isle de la Cité to its present place near Notre Dame on the north side of the island. Other interesting ancient Hôtels-Dieu are to be found at Angers (1153); Beaume, Côte d'Or (1443); and at Tonnerre, Yonne (1338).

HÔTEL DES INVALIDES, dā zăṅ'vä'lēd', an institution in Paris for the maintenance of wounded veterans of the French army. It was established in 1670 by Louis XIV. It was reorganized in 1811, and under the republic became national property. supported from the annual budget. Three buildings comprise the Invalides: The hôtel, or residence house, a huge edifice, containing also the National Museum of Artillery, a historic military museum, and some of the offices of the Ministry of War; the chapel of Saint Louis, where mass was held for the inmates; and the Dome des Invalides, a royal sepulchral edifice, to which the remains of Napoleon Bonaparte were transferred in 1861. The Hôtel proper can accommodate about 6,000 inhabitants.

HÔTEL DE VILLE, dė vēl, or dė vē′, the town-hall of the French municipalities. Excellent ancient types are to be found at Saint Antonin Compiègne, Orléans and Saint Quentin. The famous Hôtel de Ville at Paris was first erected in the 16th century. It was burned by the Communists in 1871 and was rebuilt between 1873–83. The distinguishing feature of the new building is its fine façade containing sculptured allegorical groups and statues representing the principal cities of France. Excellent statues and pictures ornament the interior.

HOTELS, LODGING-HOUSES, Regulations of, the legislation enacted in different States to secure efficient service in buildings in which people are lodged for hire and provided with meals. These regulations vary according to localities, but generally have been directed toward fire prevention, means of exit, limitation of height and the rights of travelers. The legislative regulations are usually to be found posted in a convenient place for guests to consult. See Hotels in America.

HOTELS IN AMERICA. The public house, or hotel, was established in the early days of the colonies to afford accommodation for those who might be compelled to journey from one place to another. As roads were poor, in those days, and stage transportation was slow, many of these houses were opened along the principal roads, or turnpikes, and the majority of these so-called inns bore such names as «King's,» «Queens,» «The Red Lion,» etc. As public opinion changed, however, and the colonies inaugurated their revolt against the Crown, there was a corresponding change in the names of these hotels which brought them into closer harmony with the spirit of the times. From being mere public houses, wherein beds and food might be obtained by travelers, they became the meeting places of patriots, so it was but natural that the portrait of Washington, or of some other great American, should have taken the place of that of George III, and other royal personages, on the swinging signs before these doors. As time passed and the patriotic spirit rose to greater heights, these inns became the scenes of many events that brought them into the closest relation with the progress of the Revolutionary period and with the formative days which followed the declaration of peace. There was, for example, the City Tavern, in Philadelphia (1775), at which General Washington was frequently a guest; the Bunch of Grapes Tavern, Boston, where he enjoyed that «elegant dinner provided at public expense, while joy and gratitude sat on every countenance and smiled in every eye» (28 March 1776); the True American Inn, at Trenton (1777); Arnold's Tavern, Morristown; Sufferin's Tavern, Smith's Clove, N. Y.; the Buck Tavern, near Philadelphia; Smith's Tavern, Smith's Clove, N. Y. (1779); the tavern at East Chester, N. Y., where he was ill (1780); the Fountain Inn, Baltimore (1781); Day's Tavern, Harlem, where he stopped with Governor Clinton (1783); Fraunces Tavern, New York, where, in the assembly-room, he bade farewell to the men who had followed his fortunes so faithfully; Mann's Hotel, Annapolis, from which he proceeded to Congress on the day when he resigned his commission, and the City Hotel, Alexandria, where he was afterward entertained by the Alexandria Lodge, of which he was a member. The tavern at East Chester, where Washington stayed during his illness, was erected soon after the beginning of the 17th century. At one time Lafayette was entertained in the house, and, for a season, it was practically the seat of the national government, President John Adams having taken refuge at East Chester during the yellow fever epidemic at Philadelphia, then the Federal capital. This tavern now stands within the New York city limits, and the rooms which have the greatest historic interest still preserve the same appearance which they had in those old days.

Among the other taverns of the country which are rich in historic memories, but which were not directly associated with the career of the first President, were the Catamount Tavern, at Bennington, Vt.; George Burns' Coffee-House, in New York, long the lounging place of the British officers, although privately frequented by the Sons of Liberty during the occupation of the city by the British; the Tun Tavern, Philadelphia, the house in which the first Masonic lodge in America was organized; the City Tavern and the Bird in Hand, at Richmond, Va., and the Rose Tree Inn, at Media, Pa.

The first hotels in this country were conducted on the so-called American plan, which provided a fixed price for a day and for each fraction of a day. In those times $1 a day was considered a «good round price,» and taverns were ordinarily so small that one which was provided with 20 rooms was regarded as a most commodious house. The rooms were usually comfortable, however, and were neatly, if plainly, furnished with strongly made furniture. Carpets were rarely found, although hand-woven rag-rugs frequently appeared on the floors. Meals, which were served at fixed hours only, were announced by the ringing of a bell or gong, and all guests were expected to respond as quickly as possible. The table was abundantly supplied with dishes that were both substantial and palatable, the cooking being done by the wife of the landlord, with such assistants as the patronage of the inn might authorize, and while meat dishes predominated, game was so plentiful that its appearance attracted no comment.

At this time in the history of the American public house there were comparatively few inns that made an extra charge for wines. Instead decanters of liquors and of some favorite wine, like Madeira, port or sherry, frequently stood upon the tables, and from these the guests served themselves freely. There were no printed bills of fare in these days, but practically all the food to be served was placed on the table at one time. Guests helped themselves, some slight assistance being given by the waiter who stood at hand. When Congress met in New York in 1789 the members found accommodations chiefly in the boarding-houses which abounded in the neighborhood of the Battery — on lower Broadway, in Cedar street and in Maiden Lane. It is rather amusing to note that people from other parts of the country complained about the «high prices» that were charged at the taverns and boarding-houses in New York, for that was the time when the «board of the Congressmen was paid out of the common treasury, to which every citizen of the United States contributed his share.» In reply to this charge of exorbitant prices it was stated that board in New York «ranges from $3 to $7 per week,» and one house was cited as furnishing «from 7 to 9 dishes a day, with 4 sorts of liquor.»

The most important American taverns in 1795 were located in New York, Philadelphia, Baltimore and Boston. The best New York taverns were Fraunces', opened in 1762, and formerly known as the Queen Catherine, one of the largest inns during the Revolutionary period, as it contained some 30 rooms; the City Hotel, which was erected on the site of the George Burns Coffee House, in 1793, and which was not only the meeting place of the fashionable City Assembly, but was patronized by the so-called «Three Hundred» of that day; Bunker's, the Washington Tavern and the Tontine Coffee House, on Wall street.

The National Hotel, in Washington, which was for many years the home of the most eminent public men of the nation, was opened in 1827. In 1829 the Tremont House was opened in Boston, and for years it was noted as being the grandest hotel in the land, if not the most elegant public house in the world. Prior to that time the principal hotels in Boston had been the Eastern Stage House, Doolittle's City Tavern and the Lamb Tavern.

It was about that time, or, to be exact, in 1830, that Delmonico opened the first high-class restaurant in New York. High as his prices were, when compared to those which prevailed elsewhere, epicures and persons of fashion flocked to his support and the enterprise prospered from the day of its inception. In 1833 the United States Hotel, in New York, was opened; in 1834 the Louisville Hotel, and, in 1835 the Galt House, also at Louisville, all of which immediately became noted as fine houses. The United States Hotel, at Boston, which has since been greatly enlarged and is still standing, was opened in 1835, while, about this time, the old Washington Hotel, at Portland, Me., which had been established since 1823, also took the name of the United States. The Rockingham, at Portsmouth, N. H., once the home of Governor Langdon, was opened in 1834, but, like other hotels of that time it was not particularly commodious in the modern sense of the word. In fact, up to 1836, there were comparatively few hotels in the United States that were capable of accommodating as many as 200 persons. In 1836 the Astor House, in New York, was opened. Built of massive granite, and furnished with all the conveniences of that day, it was a fitting rival to Boston's Tremont House. Barnum's Hotel, at Baltimore, which was opened at about this time, eclipsed the best houses which had hitherto been built in that city, while the opening of the Saint Charles Hotel, at New Orleans, in the same year, was an event which was heralded from one end of the land to the other. Situated in the centre of the «American» portion of the city, its stately portico, built in the style of a Corinthian temple, made it, next to the Capitol, at Washington, the most imposing structure in the land. It was also one of the best appointed and most commodious houses in America, having accommodations for more than 700 persons. The original buildings were burned in 1851, but it was almost immediately rebuilt, and it continued to enjoy its position as the centre of Southern hotel life until the outbreak of the Civil War. In 1894 the structure was once more burned, but it has since been rebuilt, and still ranks as one of the best hotels in America.

The Charleston Hotel, at Charleston, had the distinction of being the only hotel in the country that had been burned to the ground on the same day on which it was opened. This was in 1839, but as it was rebuilt at once it was again opened in 1840, afterward becoming the favorite resort of Calhoun and other great Southern statesmen. When the Planter's House, at Saint Louis, was opened in 1841, it justly prided itself upon being «the largest hotel west of the mountains.» It had 215 well-furnished rooms, a classic ballroom with a floor-space «8,911 square feet more than the celebrated Tremont House, in Boston,» while the china and cutlery, all of which was made in England, bore the name of the house. Charles Dickens, who stopped there in 1842, spoke favorably of the hospitality of this hotel in his 'American Notes.' The Massassoit House, at Springfield, Mass., one of the celebrated New England hotels, and the New York Hotel, were both opened in 1848. The Delevan House, at Albany, was opened in 1845. The year 1847 will always be a memorable one in the history of the American hotel, for it marks the date of the opening of the Revere House, Boston, a house which, under the management of Paran Stevens, soon became the pattern which all other hotels in this country sought to imitate.

Up to 1855, the principal hotels in Philadelphia were the Mansion House, the United States, the Washington City and the Girard House, and it was in that year that the Burnett House, at Cincinnati, was opened with 250 bedrooms, besides many drawing-rooms, and especially spacious corridors. The Eagle Hotel, at Richmond, where Lafayette had stopped in 1824, was burned in 1840, and the Exchange and Ballard's were afterward opened. The Clarendon and the Irving House, in New York, were opened about 1850. The first Tremont House, at Chicago, which for some time was the leading hotel in that city, was opened about this time, while the Battle House, at Mobile, the Saint Louis Hotel, at New Orleans, and the Saint Nicholas and the Metropolitan, in New York, were opened about 1852. All were large houses, and were conducted upon an expensive scale, while the two New York houses were particularly conspicuous in having introduced «bridal chambers» and other novelties.

In 1854, the Brevoort and the Everett were opened, on the European plan, in New York; the famous Parker House, in Boston, also on the European plan, was opened in 1855, while the Fifth Avenue Hotel, in New York, was finished in 1859. It was the first hotel to introduce a passenger elevator.

Willard's Hotel, at Washington, was the focus of many thrilling scenes and events during the Civil War, and among the houses that were opened during the next few years were the Lindell and Southern hotels, at Saint Louis; the Albemarle, Hoffman, Saint James and Grand, in New York, and the Arlington, at Washington. The Gilsey House, which was opened in 1871, in New York, at once took rank as one of the best European-plan hotels, while the Windsor House, in New York, began the successful career that ended so disastrously in the fire of 1899, in 1873. The Brunswick, in Boston, and the Palmer and Grand Pacific, both in Chicago, were opened about this time, while the Palace Hotel, at San Francisco, one of the most famous and palatial houses in the Far West, began to receive guests in 1875.

The last two decades of the 19th century were conspicuous, not only for the sudden increase of new and more splendid hotels, but also for the enlargement and improvement of those already built, in every part of the country, while, in such a brief review of the hotel business, it is impossible to name all the hotels worthy of mention that have been built during the past 25 or 30 years, it may justly be said that the revival of interest in the making of new and better houses extended from the Atlantic to the Pacific, and from our northernmost boundary to the Gulf. Beginning with the Vendome and Young's, at Boston, the list would include the Narragansett, at Providence; the Grand Union, Park Avenue and Murray Hill, in New York; the Lafayette and Stratford, at Philadelphia; the Rennet, at Baltimore; the De Soto, at Savannah; the Kimball, at Atlanta; the Iroquois, at Buffalo; the Hollenden, at Cleveland; the Grand, at Cincinnati; the Cadillac and Russell, at Detroit; Auditorium, Blackstone and LaSalle, at Chicago; Plankinton, at Milwaukee; the Ryan, at Saint Paul; the West, at Minneapolis; the Coates House, at Kansas City; Brown Palace Hotel, at Denver; the Portland, at Portland, Ore., and the Tacoma, at Tacoma. The impetus to the hotel business, which began some 30 years ago, however, has continued up to the present time for the last few years have witnessed the construction of many new and finer hotels than any that had hitherto been built, among them being the Imperial, the Savoy, the Holland, the Waldorf, the New Astor, the Martinique, McAlpin, Knickerbocker, Ritz-Carlton, Plaza, Belmont, Saint Regis, Vanderbilt, Biltmore, Pennsylvania and the Commodore, while one of the most unique experiments in the hotel line was the establishment of the Martha Washington, a hotel exclusively for women, which is successfully operated, also in New York.

The watering-place and summer-resort hotels also represent an important and rapidly increasing branch of the business. At the beginning of the 19th century there were a few inns at places like Saratoga, while a tavern at the White Mountains was built by Crawford in 1803. In 1822, the Catskill Mountain House was opened, and, by 1840, there were good houses at Trenton Falls and Delaware Water Gap. Twenty years later, Newport, Nahant, the White Mountains, Lake George, Saratoga, Niagara, Cape May, Old Point Comfort, and the Virginia springs, all had good hotel accommodations, but, since that time this branch of the business has grown to such an extent that splendid hotels are now located on almost every available spot on the coast from Maine to Florida, while the Adirondacks, the Catskills and many interior resorts have accommodations for guests that can compare favorably with the best hotels in the country. At such hotels the American plan usually prevails, as it does to a considerable extent throughout the smaller cities and towns. In the large cities, however, the European plan, which fixes a price for the room, and which charges for extra service and for each item on the bill of fare, has become more popular, for while, in some instances, the two plans are combined, it is the European plan that is generally followed by the large hotels. Moreover the charges at the best hotels are about twice as great as they were in 1850.

The year 1914 was a great era of hotel building enterprises. The following year showed a remarkable decrease in the number of new hotels, but was enlivened by the noticeable sumptuousness of the larger erections; these included the mammoth Hotel Traymore, at Atlantic City, N. J.; the Hotel Morrison, Chicago, with 1,600 bedrooms; the fine Hotel Pantlind at Grand Rapids, Mich.; the attractively designed Hotel Muhlbach, Kansas City, Mo.; the Adelphia Hotel, Philadelphia, built of brick and terra-cotta; and the great William Penn Hotel, Pittsburgh, Pa., 20 stories high with 900 rooms.

When compared with the palatial hotels of to-day even the fine houses like the Tremont and the Astor House were primitive in their construction and management. The modern hotel is equipped with running water and set basins in every room; many rooms also have water-closets and baths with exposed plumbing; everywhere there are open grates and steam heat, improved ventilation, elevators for both passengers and baggage, electric bells, telephones and every possible device to prevent fire, or to assure the safe escape of guests in case of a conflagration. Utensils and machinery have also multiplied greatly during the past few years, for the best hotels now run a thoroughly up-to-date laundry, an electric-lighting plant, apparatus for the distilling of water, and the most elaborate cold-storage conveniences, often including an individual ice-making plant, while among the other necessary conveniences of every well-equipped hotel one may mention the reading, writing and music rooms; the coat, package and baggage rooms; the barber shop, with its manicuring, boot-blacking and other accessories; the billiard-room; telephone, telegraph and ticket offices; the book and newsstand; the stenographers and typewriters, and the carriage and messenger services, not to mention a score of other details that are just as imperative a necessity. It is no uncommon thing to-day to find single hotel structures valued at $3,000,000 or $5,000,000 equipped with furnishings costing many hundred thousand dollars.

A conservative estimate of the number of hotels in the United States, in a recent year, exclusive of those in process of erection, places the number at over 50,000. Of these about 4,000 are summer or winter resort hotels, 3,000 are family hotels, while the balance are commercial houses. These hotels now give employment to no less than 4,000,000 persons, and the amount of capital invested in the business is undoubtedly in excess of $6,500,000,000. Consult 'Hotel Red Book: the United States Official Hotel Directory' (New York 1886–1918).

HOTHAM, hŭth'ăm, **William**, British admiral: b. 1736; d. 1813. He received his education at Westminster School and at the Royal Naval Academy, Portsmouth, and entered the navy in 1751. He was assigned to the North American waters, and received his first commission as lieutenant on the *Saint George,* the flagship of Sir Edward Hawke. He rose rapidly in rank, becoming commander of different frigates. In 1759 his ship captured a French frigate, which, pressed into service, made a number of other captures. From 1776–81 he continued to serve in American waters, taking an important part in the Cul de Sac of Saint Lucia in the West Indies in 1778. He was returning with a large fleet of merchantmen when he was attacked by a French force and lost a number of his ships. He assisted in the operations at Gibraltar under Lord Howe (1782), and was appointed rear-admiral (1790) and later vice-admiral. On the retirement of Admiral Hood, Hotham succeeded to the chief command. In 1797 he was created a peer of Ireland, under the title of Baron Hotham of South Dalton.

HOTMAN, François, French author and jurist: b. Paris, 23 Aug. 1524; d. Basel, 12 Feb. 1590. At the age of 15 he was sent to the University of Orleans. In 1542 he obtained his doctorate and became a pleader at Paris. In 1546 he became lecturer in Roman law at the University of Paris. He was converted to the Reformed faith soon afterward; went first to Geneva, and then to Lausanne, where, on Calvin's recommendation, he was appointed to the chair of *belles-lettres* and history. In 1555 he lectured on law at Strassburg and in the following year became professor there. His fame extended to foreign countries and he was sought by various rulers, including Elizabeth of England. He was made professor of civil law at Valence in 1564 and three years later was appointed to the chair of jurisprudence at Bourges. Soon afterward he fled to Paris and was for a short time historiographer to the king. On several occasions he was Ambassador of the Huguenots and in 1568 negotiated the Peace of Blois. He returned to Bourges but fled after the massacre of Saint Bartholomew to Geneva, where he was made professor of Roman law. In 1579 he removed to Basel, where, with the exception of short sojourns in Montbéliard and Geneva, he spent the remainder of his life. He wrote numerous works, mostly polemical, including 'De gradibus Cognationis' (1546); 'L'Anti-tribonien, ou discours sur l'étude des lois' (1567); a life of Coligny (1575); 'Brutum fulmen' (1585); 'Franco-Gallia,' his greatest work (1573). Consult Dareste, R., 'Essai sur Hotman' (1850); and Grégoire, E. (in Nouvelle biographie générale' (1858).

HOTTENTOTS, hŏt'ĕn-tots, an African race, the aboriginal occupants of the south end of that continent, near the Cape of Good Hope. The name now given to the whole race was that of the tribe in the immediate vicinity of the Cape of Good Hope, with which the Dutch settlers first became acquainted. The origin of the name is unknown. They are, when young, of remarkable symmetry; but their faces are ugly, and this ugliness increases with age. The complexion is a pale olive, the cheek-bones project, the chin is narrow and pointed and the face consequently is triangular. The lips are thick, the nose flat, the nostrils wide, the ears large and lobeless, the hair woolly and the beard scanty. The women in early life are often models of proportion, and their gait by no means deficient in grace. Their bloom, however, is transient, for, marrying at 12 or 13, after the first child they lose their grace and proportion, and soon become hideous. Both sexes are distinguished by excessive incurvation of the spine. When the Dutch first settled at the Cape the Hottentots were a numerous nation, and occupied a territory of 100,000 square miles. They had abundance of horned cattle and sheep; and it is supposed that the seven tribes into which they were divided made up together a population of over 100,000. At the present day this race is much degenerated and mixed within the wide territory which formerly belonged to it. They may amount to about 50,000. They are believed to be descendants of an ancient cross between the Bantu negroes (who are Hamitic) and the Bushmen. The cranial capacity is little above that of the Bushmen, and the yellowish, leathery color also shows relationship. They are short in stature (16.3 centimeters), and many of the women have a tendency to be over fat. They are of a happy-go-lucky, friendly disposition, like many of the plantation negroes of the southern United States. In their native state they wore loin-cloths and a cloak of skin (kaross). The women added fringed girdles and often a skin cap and were fond of ivory arm-rings. When in full dress they daubed themselves freely with a sooty fat. They raised cattle and lived on the plentiful African game in small villages or kraals. They were not over-fond of work and much given to feasting and dancing. The tribal government was patriarchal, chiefs being hereditary, and kraals having each a captain, who was a member of his chief's council. A tax of a portion of the products of the chase belonged to the chief. The councils held court at times, tried cases and disposed of criminals. Murderers were stoned or beaten to death. Adultery was also often punished by death at the hands of the aggrieved husband. Thieves were beaten, starved or banished. Duelling was common, clubs or spears being the weapons. They evidently imbibed some religious ideas from the East, for they were given to ancestor worship, and oriented their huts and graves. Their language possesses much interest, and Hottentot grammars have been published in both English and German. They possess a great fund of myths and legends. The Koras or Korannas (shoe-wearers), south of the Kalahari Desert, still remain a favorable specimen of the Hottentot race. They are taller, stronger and more cleanly than some of the other tribes. Most of them possess cattle; those who do not soon degenerate into Bushmen. On the eastern frontier of the colony are still some remnants of the Gona or Gonaqua tribe; but they have nowhere preserved their ancient usages and purity of blood, but are much mixed with the Amakosa Kafirs. The Namas, who are the purest type of Hottentots now existing, dwell in Namaqualand, in German Southwest Africa. The Namas are a pastoral people, almost exclusively. Many of them have been Christianized. Consult Stow, ‘Native Races of South Africa’ (1907); ‘South African Natives’ (1900).

HOTTENTOT'S-BREAD. See ELEPHANT'S-FOOT.

HÖTZENDORF, COUNT **Conrad von,** Austrian field-marshal: b. 1852. He became chief of the Austrian general staff in 1906, and in that capacity made annual visits to the German general staff in Berlin. In March 1917 he was relieved at his own request in order to assume a command in the field. In the following August he was appointed to the chief command of the Austro-Hungarian forces. He had made a special study of mountain warfare, a factor that no doubt contributed materially to the Austro-German victory over the Italians on the Isonzo in the autumn of 1917. Though regarded as a skilful strategist, Count Hötzendorf and practically all his generals suffered invariable defeat when unsupported by German officers and troops. It is believed that he was largely instrumental in fanning the flame of Italian animosity against Austria long before the war. He retired in July 1918. One of his sons was killed in the battle of Rawa Russka in Galicia.

HOUBRAKEN, hou-brä'kĕn, **Jacobus,** Dutch engraver: b. Dordrecht, 25 Dec. 1698; d. 14 Nov. 1780. He was the son of Arnold Houbraken, an artist of some repute. In 1707 he removed to Amsterdam, where he devoted himself to the study of the old Dutch masters. His engravings consist entirely of portraits and genre, his first work being a series for his father's book of biography of Dutch painters. His claim to fame rests chiefly on his illustrations of Cornelis Troost's comedy ‘De Ontdekte Schijndeugd.’ Consult ver Hull, Alexander, ‘Jacobus Houbraken et son œuvre’ (Arnhem 1875).

HOUDAN, hoo'dăn, a breed of domestic fowls, well known and widely cultivated in the United States. They are of medium size, mottled black and white, with black wing bars. The cock has a heavy crest which is divided in the middle of the crown. The hen's crest falls backward. They weigh from six to seven pounds and have five toes. Analogous French breeds are Crevecœur and La Fleche.

HOUDARD, oo'där', **George Louis,** French composer and musical historian: b. Neuilly-sur-Seine, 1860. He studied under Hillemacher and Massenet, and devoted his efforts to the study of musical history. In this field he wrote ‘L'Art Dit Grégorien d'après la notation neumatique’ (1897); ‘Le rythme du chant dit Grégorien d'après la notation neumatique’; ‘La richesse rythmique musicale de l'antiquité’ (1903); ‘La cantilène Romaine’ (1905); ‘La rythmique intuitive’ (1906); ‘Vademecum de rythmique grégorienne’ (1912). Houdard has composed sacred music, of which the best-known work is a ‘Requiem.’

HOUDETOT, oo'd'tō', **Elizabeth Françoise Sophie de la Live de Bellegrade,** COMTESSE d', French woman of society: b. 1730; d. 1813. She married, in 1748, Claude Constance César de Houdetot, lieutenant-general of the French army, by whom she became the mother of César Houdetot, governor of Martinique and lieutenant-general under the empire. She was the sister-in-law of Madame d'Epinay. Her liaison with the Marquis of Saint Lambert lasted a number of years. Her fame rests chiefly on Rousseau's descriptions in his ‘Confessions’ of his unrequited passion for her. She is generally described as plain in appearance, but of sprightly wit and amiable temperament.

HOUDON, Jean Antoine, zhŏn äṅ-twän oo-dôṅ, French sculptor: b. Versailles, 20 March 1741; d. Paris, 15 July 1828. Having gained the first prize for sculpture in the École des Élèves Protégés at Paris in 1761, he went in 1764 to Italy where he studied at the Academy in Rome until the latter part of 1768. There he finished, among other works, the statue of Saint Bruno in the church of Saint Maria degli Angeli. Returning to Paris, he executed admirable busts of Rousseau, Diderot, D'Alembert, Franklin, Turgot, Mirabeau, Gluck, Barlow, Fulton, Jefferson, John Paul Jones, Lafayette, Molière, Napoleon, Voltaire, Washington and many other distinguished men and women; statues of Voltaire and Tourville; the celebrated ‘Diana’ for the empress of Russia; and other works, which placed him in the first rank of French sculptors. In 1775 he was made a member of the Academy of Painting and Sculpture where he taught for many years. In 1785 he accompanied Franklin to the United States, to prepare the model for the statue of Washington ordered by the State of Virginia, and passed two weeks at Washington's residence at Mount Vernon for that purpose. The statue, bearing the sculptor's legend, “*Fait par Houdon, citoyen Francois*, 1788,” now stands in the hall of the capitol of Virginia at Richmond, where there is also one of his marble busts of Lafayette. Among Houdon's later works is the celebrated statue of Cicero ordered by Napoleon I for the Senate chamber. Specimens of his work are in many public buildings in Paris and in many European museums, especially in the Louvre. The Metropolitan Museum of Art, New York; Pennsylvania Academy of Fine Arts, Philadelphia; National Academy of Design, New York; American Philosophical Society, Philadelphia; Girard College, Philadelphia and the collections of B. Altman, H. C. Frick, J. P. Morgan and other art patrons possess valuable examples of his skill. Some of his works have in recent years brought very high prices when sold at auction, a marble bust of one of his little daughters selling in 1912 at Paris for $90,000. Consult Borgmeyer, C. L., ‘Among Sculptures’ (in *Fine Arts Journal*, Vol. XXX, p. 199, Chicago 1914); Délerot, E., and Legrelle, A., ‘Mémoire sur la Vie et l'œuvre de J. H. Houdon’ (in *Mémoires de la Société des Sciences Morales de Seine-et-Oise*, Vol. IV, p. 49, Versailles 1857); Dierks, H., ‘Houdons Leben und Werke’ (Gotha 1887); Hart, C. H., and Biddle, E., ‘Memoirs of the Life and Work of J. A. Houdon’ (Philadelphia 1911); Montaiglon, A. de, and Duplessis, G., ‘Houdon’ (in *Revue Universelle des Arts*, Vols.

I and II, Paris 1855–56); Quincy, Qu. de, ‘Notice Historique sur la Vie et les Œuvres de M. Houdon’ (Paris 1829); Réau, L., ‘L'œuvre de Houdon eu Russie’ (in *Gasette des Beaux-Arts,* Periode iv, Vol. XIII, p. 129, Paris 1917); Smouse, F. I., ‘Houdon en Amerique’ (in *Revue de l'Art,* Vol. XXXV, p. 279, Paris 1914); Taft, L., ‘J. A. Houdon’ (in *Scribner's Magazine,* Vol. LIII, p. 659, New York 1913); Terrade, A., ‘Autour de la Statue de Jean Houdon’ (Versailles 1892); Vitry, P., ‘Works of Houdon in America’ (in *Art in America,* Vol. II, pp. 217 and 368, New York 1914).

HOUGH, hŭf, **Emerson,** American author: b. Newton, Iowa, 28 June 1857. He was graduated from the State University of Iowa in 1880, traveled extensively in the wild portions of the West, was for several years a writer in Chicago, and there became in 1899 western manager of the New York periodical *Forest and Stream.* His publications are ‘The Singing Mouse Stories’ (1895); ‘The Story of the Cowboy’ (1895); ‘The Girl at the Half-way House’ (1900); ‘The Mississippi Bubble’ (1902); ‘The Way to the West’ (1903); ‘The Law of the Land’ (1904); ‘Heart's Desire’ (1905); ‘The King of Gee Whiz’ (1906); ‘The Story of the Outlaw’ (1906); ‘The Way of a Man’ (1907); ‘Fifty-four Forty or Fight’ (1909); ‘The Sowing’ (1909); ‘The Young Alaskans’ (1910); ‘The Purchase Price’ (1911); ‘Young Alaskans on the Trail’ (1911); ‘John Rawn’ (1912); ‘The Lady and the Pirate’ (1913); ‘Young Alaskans in the Rockies’ (1913); ‘The Man Next Door’ (1916); ‘The Broken Gate’ (1917).

HOUGH, George Washington, American astronomer: b. Montgomery County, N. Y., 24 Oct. 1836; d. Evanston, Ind., 1 Jan. 1909. He was graduated at Union College in 1856 and received the A.M. degree from Harvard in 1859. In the same year he was appointed assistant astronomer at the Cincinnati Observatory; in 1860 he became assistant astronomer and in 1862 astronomer and director of the Dudley Observatory, Albany, N. Y. In 1879 he became director of the Dearborn Observatory and professor of astronomy at the Chicago University; upon the removal of the Dearborn Observatory to Evanston he accepted a similar position at Northwestern University. He invented several astronomical instruments and discovered more than 600 double stars. He was also the inventor of the recording and printing barometer (q.v.) and of the anometer (q.v.). He belonged to many scientific societies, both in this country and abroad, amongst them being the Royal Astronomical Society of England. He wrote ‘Annals of the Dudley Observatory’ (Albany 1866–71). Consult Doolittle, E., ‘Catalogue and Re-measurement of the 648 Double Stars Discovered by Prof. G. W. Hough’ (in *University of Pennsylvania Publications, Series in Astronomy,* Vol. III, part 3, Philadelphia 1907).

HOUGH, Walter, American ethnologist: b. Morgantown, W. Va. (Va.), 23 April 1859. He was educated in Monongalia Academy, public schools and West Virginia University, graduating A.B. in 1883. He was granted Ph.D. *pro honoris causa* in 1894; admitted Phi Beta Kappa 1913. After teaching in common schools and at Wyman Institute, Upper Alton, Ill., he was appointed to the division of ethnology, United States National Museum, January 1886, becoming curator in 1910. For services in connection with the Columbian Exposition of Madrid, 1892–93, he was knighted by Maria Christina, queen regent of Spain. He carried on field work in ethnology and archæology in Arizona and New Mexico, 1896–1907, and published numerous papers on ethnology and Pueblo Indian archæology. He was secretary of the Anthropological Society of Washington, 1901, and president, 1908.

HOUGH, Warwick, American jurist: b. Loudoun County, Va., 26 Jan. 1836; d. 28 Oct. 1915. He was graduated from the University of Missouri in 1854, studied law and was admitted to the bar in 1859. In January 1861 he was appointed adjutant-general of Missouri, as such issuing the general order under which the State military organizations went into camp on 3 May. He was for a short time secretary of state in Missouri, resigning in 1863 to enter the Confederate service, and serving on the staffs of General Polk and other Confederate commanders. For a few years after the war he practised law in Memphis, Tenn., but afterward returned to Missouri, establishing himself in Kansas City. He was a judge of the Missouri Supreme Court 1874–84, for two years of that period serving as chief justice of the State. In 1884 he removed to Saint Louis, where he was circuit judge 1901–07, and after leaving the circuit bench, associated with his son, Warwick Massey Hough, continued in the active practice of his profession until his death in his 80th year.

HOUGHTON, George Hendrick, American Protestant Episcopal clergyman: b. Deerfield, Mass., 1820; d. 1897. He was graduated at New York University in 1842 and at the General Theological Seminary in 1845. He organized and was rector of the church of the Transfiguration in New York city, which bears the sobriquet «The Little Church Around the Corner.» The origin of the name is narrated as follows: A certain actor died and was refused burial services by a prominent city pastor. The reverend referred him to the «little church around the corner» where Dr. Houghton performed the services. Throughout his long pastorate, Dr. Houghton was distinguished for his charitable work.

HOUGHTON, hō'tŏn, **Henry Oscar,** American publisher: b. Sutton, Vt., 30 April 1823; d. North Andover, Mass., 25 Aug. 1895. He was apprenticed in 1836 to a printer in Burlington, Vt., and in 1842 entered the University of Vermont, where he was graduated in 1846. Going soon after to Boston he became a member of the Cambridge printing firm of Freeman & Bolles which was then changed to Bolles & Houghton in 1849, and founded the «Riverside Press» in 1852, which has since then become one of the biggest and best-known book printing establishments in the United States. In 1864 he formed the book publishing firm of Hurd & Houghton, now the widely known house of Houghton, Mifflin & Co. In 1872 he served as mayor of Cambridge. For many years he was a trustee of Boston University. He was one of the principal figures in the development of printing in the United States during the second half of the 18th century, both in regard to quantity and to quality, and was also a strong and sincere supporter of the movement for international copyright. Consult Scudder, H. E., ‘Henry Oscar Houghton’ (Cambridge 1897).

HOUGHTON, how'tŏn, **Richard Monckton Milnes,** Baron, English poet: b. Fryston Hall, near Pontefract, Yorkshire, 19 June 1809; d. Vichy, France, 11 Aug. 1885. He was educated at Cambridge University and became prominent in Parliament as a moderate Conservative. He was raised to the peerage in 1863. He was long distinguished as the friend of famous authors, notably Tennyson and Swinburne, and himself the author of several volumes of verse and prose, including a ‘Life of Keats’ (1848). Consult Reid, T. W., ‘Life, Letters and Friendship of R. M. Milnes’ (London 1910).

HOUGHTON, William Stanley, English dramatist: b. Manchester, 1881; d. 1913. After being graduated from the Manchester Grammar School, he worked for a time in the cotton trade. His natural proclivities tended toward the drama, however, and in 1906 he became assistant dramatic critic and reviewer for the *Manchester Guardian*. Among his plays the best are ‘The Dear Departed’ (1908); ‘Independent Means’ (1909); ‘The Master of the House’; ‘The Younger Generation’ (1910); ‘Hindle Wakes’ (1912, also produced in New York in 1913); ‘Fancy Free’; ‘Phipps’; ‘Pearls’ (1912) and ‘Trust the People’ and ‘The Perfect Cure’ (1913). Most of his plays were produced by the Repertory Players in London and at the Horniman repertory theatre in Manchester. A collection of his one-act plays was published in 1913 under the title ‘Five One-Act Plays.’

HOUGHTON, Mich., a village and the county-seat of Houghton County, 94 miles northeast of Marquette, on the south bank of Portage Lake, and on the Copper Range, Mineral Range and Duluth, S. S. & A. railroads. Portage Lake is connected with Lake Superior at the south by the Portage River and at the north by a ship-canal by means of which steamers avoid the detour around Keweenaw Point. Houghton is the centre of the rich mineral district in the peninsula of Keweenaw, the total output of which is approximately 150,000,000 pounds. The larger part of the copper export of the region is shipped from this port. There is also considerable lumbering, manufacture and commerce, and the shipping interests are important. The various industries have about 1,000 employees. It is the seat of the Michigan College of Mines, which was founded in 1885 and occupies a fine structure. There are Episcopal, Methodist Episcopal, Catholic and Presbyterian churches. Mention should also be made of the county courthouse. Houghton was first settled in 1851. Its government is by a president and a council of six members elected biennially, three in each year. Pop. 5,113.

HOULDING, John Richard («Old Boomerang»), Australian writer: b. in England and was taken as a child to Australia. He wrote for numerous newspapers and magazines. His published works include ‘Adventures of Christopher Cackle’; ‘Australian Sketches and Tales from Real Life’; ‘Fortunes of the Stubble Family’; ‘Investing Uncle Ben's Legacy’; ‘Adventures of a Young Governess’; ‘Roger Larksway's Strange Mission’; ‘In the Depth of the Sea’; ‘A Flood that Led on to Fortune.’

HOULT, Joseph, English shipowner: b. Liverpool, August 1847; d. Penrith, Cumberland, 18 Oct. 1917. He began his business career as a youth at a salary of $300 a year, and at 21 launched out for himself as a shipbroker. He established the firm of Joseph Hoult & Company, steamship owners, of Liverpool, and built up a very prosperous business. Shortly before his death he made a gift of $350,000 in War Loan stock, for charitable distribution. He offered a reward of $2,500 apiece for four German submarines destroyed by any British ship. He sat in Parliament as a Conservative member for the Wirral division of Cheshire from 1900 to 1906.

HOULTON, hōl'tŏn, Me., town and county-seat of Aroostook County, in the eastern part of the State, on the Canadian Pacific and Bangor and Aroostook railroads, 138 miles northeast of Bangor. Houlton is the trade centre for a large agricultural section, abounding in wonderful possibilities and immense agricultural riches. Industries are composed of fertilizer factory, starch factories, woolen mill, long and short lumber mills, carriage factory, foundry and machine works, flour mills, creameries, stave and barrel mills. The water, light and sewerage systems are owned by the town. There are two newspapers, free public library of 10,000 volumes, seven churches, high school and graded schools, also a preparatory school, private; four banks, with deposits of over $2,000,000. Seat of county buildings. Pop. (1915) 6,729.

HOUMA, hoo'mą, La., city, seat of Terrebonne Parish, on the Bayou Terrebonne, the Barataria Canal, and the Southern Pacific Railroad, about 72 miles southwest of New Orleans. It is situated in an agricultural region where the principal crops are rice, sugar-cane and grain. The canning of oysters is one of the important industries; it has a large moss-factory, lumber yards, municipal-owned waterworks and electric-lighting plant. Houma — signifying mound — was the original home of the Houmas Indians. Pop. 5,845.

HOUND, a dog that hunts by scent, a definition which excludes the greyhound (q.v.). It is difficult to determine from what stock the English hound has originally sprung, but the old «Southern hound» or talbot was most probably the source of the various hounds now known, among which the bloodhound, foxhound, beagle, harrier, dachshund, turnspit, otterhound and boarhound (now known as Great Dane) are the principal varieties. The mastiff (q.v.) ought also to be included in this group. See Dog.

HOUNSLOW HEATH, a region west of the township of Hounslow, London, formerly a resort of highwaymen. A military camp was established on the heath in 1686 by James II, and in the next century extensive barracks were built. Powder-mills now cover part of the territory; the rest is cultivated.

HOUR-GLASS, a primitive instrument for measuring time. It consists usually of two hollow bulbs joined one above the other, and having a narrow neck of communication, with means for placing either bulb in uppermost position. Dry sand is introduced in quantity sufficient nearly to fill one of the bulbs and fine enough to pass freely through the orifice of the connecting neck. The quantity of sand is adjusted to the time which the glass has been constructed to indicate. In the case of an hour-glass the sand in the upper bulb takes an hour to pass into the lower bulb; and so on for any other definite division of time. This instrument is always subject to slight error in its indications of time, owing to the expansion and contraction of the glass by changes of temperature, and by the variations of dryness in the sand. The hour-glass was commonly used in churches during the 16th and 17th centuries to regulate the length of the sermon, and in some places it continued in use down to the beginning of the 19th century.

HOURIS, hoo'- or how'rĭz, the «black-eyed» nymphs of Paradise, whose company, according to the Koran, is to be one of the rewards of the faithful. They are described as most beautiful virgins endowed with perpetual youth. They dwell in beautiful gardens, by flowing streams, have none of the failings but all of the virtues of the sex, and delight in catering to the comfort and pleasures of those good Mohammedans who die in the faith.

HOURS, Book of, a devotional book for the use of the laity, popular in Catholic countries from the 14th to 16th centuries. It contained an almanac, calendar of the feasts and various devotional selections, litanies, prayers, etc. Some of the ancient books are printed with great care and are beautifully illuminated. Those belonging to royal families were often illustrated by artists according to the taste of the owner. Consult Langlois, ‘Essai sur la calligraphie des manuscrits du moyenâge et sur les ornements des premiers livres d'heures imprimés’ (Rouen 1841); Soleil, F., ‘Les heures gothiques’ (ib. 1882); Wordsworth and Littlehales, ‘Old Service Books’ (London 1890).

HOURS, Canonical. See CANONICAL HOURS.

HOURWICH, hoor'wich, **Isaac Aaronovich,** American statistician: b. Vilna, Russia, 26 April 1860. He was graduated at the Classical Gymnasium at Minsk in 1877 and studied medicine at the Saint Petersburg Academy of Medicine and Surgery. The Demidor Juridical Lyceum at Yaroslav awarded him the degree of LL.M. in 1887. Emigrating to the United States, he became Seligman Fellow at Columbia, receiving the degree of Ph.D. in 1893. He is a member of the Russian bar (since 1887), of the Chicago bar (since 1893) and of the New York bar (since 1896). From 1893–95 he was instructor in statistics at the University of Chicago; translator of the bureau of the mint at Washington (1900–02); expert special agent of the Bureau of Census (1902–06); statistician of the public service commission, New York (1908–09); expert special agent on mining, Bureau of the Census, 1909–13. Dr. Hourwich is also prominently connected with various Jewish philanthropies and the municipal reform movement. Among his works are ‘Peasant Migration to Siberia’ (in Russian, 1887); ‘The Economics of the Russian Village’ (1893); ‘Immigration and Labor’ (1912); ‘Mooted Questions of Socialism’ (in Yiddish, 1917).

HOUSANTONIC, hoo-sa-tŏn'ĭk, a river which has its rise in the Berkshire Hills, in the western part of Massachusetts, and flows south, through Connecticut, into Long Island Sound. Its course of about 155 miles is through a hilly, mountainous country, noted for its scenic beauty.

HOUSE, Edward H., American author, journalist and musician: b. about 1843; d. Tokio, 18 Dec. 1908. Prominent in promoting friendship between Japan and the United States and in interpreting the men of the two civilizations to each other, reaching the English speaking world through his brilliant writings. Educated at the Chauncy Hall private school, Boston. As correspondent of the New York *Tribune,* he reported to that paper the John Brown episode at Harper's Ferry and was responsible for the incident of John Brown's kissing the negro mother's baby, which has been made the theme of Hovenden's painting and Whittier's poem. He accompanied, to report, the first embassy from Japan in 1860. In 1863, in London, he reported for the London *Times* the prize fight between Heenan and Tom Sayers. There he collaborated with Dion Boucicault in ‘Arrah na Pogue’ and ‘The Colleen Bawn,’ and for his friend Charles Reade wrote a chapter in ‘Griffith Gaunt.’ From 1870 he spent most of his life in Japan — in Tokio as teacher of English in the Imperial University; as editor of the Tokio *Times* (1877–81). He accompanied the Japanese expedition to Formosa in 1874 and wrote an extended account of it in a large pamphlet, besides two revelatory chapters of the modern history of Japan, for Count Okuma, in the pamphlets ‘Kagoshima’ and ‘Shimonoseki’ (1875). He held the degree of doctor of music from the University of Oxford and in Japan naturalized orchestral music, being made its imperial orchestra leader. In America, besides numerous contributions to periodicals, his books were ‘Japanese Episodes’ (1881) and ‘Lone Sarto: a Child of Japan’ (1888).

HOUSE, Edward Mandell, universally known as Colonel House, personal representative of President Wilson to European governments during the war: b. Houston, Tex., 26 July 1856. His father, Thomas William House, was an Englishman who settled in Texas and there built a mansion in which he lived with his family the life of an English country squire. A typical Westerner, Colonel House spent his youth in farming, hunting and riding. He was graduated from Hopkins Grammar School, New Haven, Conn., in 1877 and Cornell University in 1881. He made a special study of politics and economics, and though he never sought any public office, he was actively engaged in State and national politics for many years in the Democratic interest. He first came into wider prominence when President Wilson entrusted him with a diplomatic mission to Europe early in 1914, some months before the outbreak of war. Though strong premonitions of war were in the air, he found no belief in a coming conflict either in England or France, but strong military excitement in Germany. In 1915 and 1916 he again represented the President on missions to the governments of the European belligerents, and on 7 Nov. 1917, after the United States had entered the war, Colonel House arrived in London as chairman of an American mission to the Allies, to attend the deliberations of the Supreme War Council. Since then he had under his supervision the task of preparing materials for the use of the American commissioners at the eventual peace conference. At the Inter-Allied Conference of Premiers and Foreign Ministers held in Paris in November 1917 he presented the views of the American government in relation to the co-ordination of activities and unity of command. In October 1918 Colonel House again visited Europe in connection with the general peace movement and armistice question. Consult Smith, A. D. H., 'The Real Colonel House' (New York 1918).

HOUSE, a place of abode of a family or individual. The common expression, «a man's house is his castle,» is in most instances true. Except in criminal cases a man can hold his house against all comers. No sheriff can break open his door to arrest him, or seize his goods for debt, except by a writ, affidavit or search-warrant. But the house is no protection where there has been a criminal offense. Breaking into a house with the intent to rob is burglary, and to set fire to a house constitutes arson. A man may defend his house against trespassers and thieves attempting forcible entrance, even to the killing of the intruder, if it can be shown that he has used no greater force than was absolutely necessary. For the house as a structure, see ARCHITECTURE; BUILDING.

HOUSE ANT. See RED ANT.

HOUSE-BOAT, a combination of boat and house, used largely as pleasure craft on rivers, canals and lakes in Great Britain, the United States and other parts of the world. While palatial house-boats were used by Roman emperors and have been in continuous use in China since early times, the house-boat of modern days first appeared in England about 1860. It was transplanted to this country late in the 19th century, and at first found favor with only a select few; but as soon as its advantages became manifest it began to develop rapidly and advanced to a remarkable state of perfection. A «house-boat» is not a boat with two, three or four decks and a number of staterooms, but a commodious, comfortable craft arranged for the accommodation of a family party, a company of bachelors or any suggestible combination of people. It might be likened to a suite of apartments afloat.

The house-boat in England has been particularly a Thames attraction and is seen to the best advantage at Henley. There are several hundred of these floating houses on the water of the Thames. The price of a house-boat ranges from $300 to $25,000. But a comfortable craft, containing saloon, kitchen and four bedrooms may be purchased for $2,000. The Thames season lasts from June to September and is at its height in July and August. A paper published once a week chronicles the daily movements of each boat. A large house-boat may be hired for the season, including Henley, for $1,000.

In the United States the house-boat is seen to best advantage on the waters of Florida and during the summer months on the Hudson River, the Saint Lawrence River and Long Island Sound. The American vessels are larger than the English boats and more expensive. They are constructed on approved plans, and contain every possible comfort and convenience that may be found in the best equipped dwelling or suite of apartments ashore. There are spacious sleeping-rooms, larger than the staterooms on ocean steamers, a cosy sitting-room, a parlor, a library, a reception-room, all the necessary storerooms, a lavatory, a cook's galley and, in fact, everything that a well-ordered household might demand. The properly constructed houseboat has a promenade deck and a high rail encloses it so that children may play about the deck with the utmost freedom and safety. The more pretentious are lighted with gas supplied from a naphtha gas-making machine, or electric light, with the energy supplied by storage batteries.

The great charm of the house-boat is the power that its occupants possess to move it from one place to another. On dry land when a man or a family does not fancy a place he or they move away and leave the house behind. On the house-boat they take their house along with them, and they can go wherever navigable water exists. The boat can be anchored in mid-stream or moored to a pier. No persons can interfere with the privacy of those on board. It is their own floating castle. When they are tired of one place they can go to another, and they have the advantage over their land-living friends that they not only take their house along, but all their belongings, and without the aid of the baggage master.

A typical American house-boat is the *Idler*, owned by a New York gentleman and used about Alexandria Bay, in the Saint Lawrence River. The cabin has a dozen or more windows of goodly size; there is a saloon and opening from it a dining-room. The kitchen, storerooms and quarters for a servant or two are «aft.» The promenade deck has hammocks, steamer chairs, camp stools, rugs, tables, books, work baskets and flowers; here the family live, for three-quarters of the time is spent on the boat. Among other well-known house-boats on the Saint Lawrence are the *Nydia, Mavis, River God, Bohemia, Amaryllis, Merrivale* and *Summerholme.*

On the Mississippi River, Ohio River and other large streams in the Western States the house-boat is utilized for business as well as for pleasure, and floating grocery stores, photograph galleries and dry goods and notion shops are not uncommon. There is on the Mississippi at least one floating theatre built on the house-boat plan, and hundreds of small families have adopted a rudely constructed inexpensive type of boat for permanent residences. Consult Hunt, A. B., 'House Boats and House Boating' (New York 1905).

HOUSE-BOAT ON THE STYX, A, a humorous book by John Kendrick Bangs (q.v.) published in 1895. It purports to be an account of the doings and conversations of a company of literary ghosts assembled in a house-boat managed by Charon. Among the ghostly personages represented are Shakespeare, Raleigh, Dr. Johnson and many more of various degrees of renown.

HOUSE CENTIPEDE, an insect of the family *Cermatiidæ* common in the Southern States of the United States. It is a myriapod, possessing long legs and antennæ, and is conspicuous for its bright colors. It feeds on lice and smaller insects, and is harmless. Consult Howard and Morlatt, ‹Principal Household Insects of the United States› (Washington 1906).

HOUSE OF CORRECTION, an institution where disorderly persons are confined, now more commonly known as a reformatory. One of the earliest houses of correction was the Bridewell (q.v.) in London. One of the most modern is the reformatory at Elmira, N. Y., which since 1877 has been a model institution for criminal reform, and its methods an object lesson to other nations. See Elmira Reformatory; Penology.

HOUSE-CRICKET. See Gryllidæ.

HOUSE-FINCH, a familiar garden finch (*Carpodacus frontalis*) of California, grayish, with the head, neck and breast of the male scarlet-carmine. It represents a group of beautiful and interesting Pacific Coast and Mexican finches, also known as linnets and burions.

HOUSE-FLY. See Flies.

HOUSE OF LIFE, The. The manuscript which Rosetti in his love and grief at the death of his wife, buried with her and seven years later caused to be disinterred and published, contained under the general title of *Poems* a section named «Sonnets and Songs, towards a work to be called *The House of Life*.» ‹The House of Life,› as finally published in 1881, consisted entirely of sonnets, the various pieces in it ranging in their date of composition from 1848 to 1869.

From their appearance at that time until now they have held their position as one of the three or four finest sonnet sequences in English. Of this work as a complete sonnet sequence perhaps the only rivals are Mrs. Browning's ‹Sonnets from the Portuguese› and Shakespeare's ‹Sonnets.›

‹The House of Life› is divided into two parts; the first, in the Elizabethan manner at times but more often after Dante and his circle of poets, deals with the poet's love; the second, in a greater variety of manners, as found in the range of English poetry, deals with many and varied subjects out of his experience. The unique and supreme quality of these poems, as compared with poetry in general, lies in their combination of the mystical and sensuous at once, imagery that is at the same time spiritual and realistic, naïve and complex; and in singularly exquisite vividness and poignancy — sometimes strained, exotic, morbid and unregulated — and a passionate love of color and light, of moments, dreams, memories, sound, of seasons and the earth and all beauty, that makes the title, ‹The House of Life,› seem perfect and inevitable.

Stark Young.

HOUSE OF LORDS. See Parliament.

HOUSE OF REPRESENTATIVES, the branch of most State legislatures, and of Congress, which has the more numerous members, elected from smaller districts, and in some cases for shorter terms. Congress — according to the first article of the Constitution — consists of a Senate and House of Representatives. The House represents population; the Senate represents the States. Both represent constituencies and the public equally, and both are not only theoretically but practically equal. The Senate's power of confirming appointments and treaties is fully balanced by the House's power of impeachment, or originating revenue bills, and electing a President if the electors fail of a choice. Nor are the members of either as individuals presumptively superior in power to those of the other. The actual superiority of the Senate is due to the longer terms, which give the older members a parliamentary experience before which the mass of raw members of the House bow; to the seats being the subject of eager competition among the ablest politicians, so that the average public position is higher; and to the lesser membership and smaller number of new bills, which enable it to preserve more independence of the chairman's prerogative than the House. Still, a certain glamour always surrounds the latter as the «popular branch»; partly due to the fact that, owing to its great number and short terms, popular movements are more quickly transformed into legislative action than in the Senate. In this respect alone the idea is correct; a party entrenched in the Senate has often boasted that no matter what the majority of the people wished it could not be dislodged for at least eight years, or the time of two presidential elections, in which anything might happen.

In its formation, the model in the State legislatures was simply to follow the old colonial form of council and assembly — the political theory of «checks and balances» being more potent, however, in defining the distribution of powers than in creating the forms of the houses. The actual form of Congress was a compromise, without which the Union could not have been formed. The large States were averse to being outweighed by the small, and wished for a two-chambered body, with representation in each proportionate to population; the small ones were determined on a single-chambered one, with each State having one vote. The present arrangement was the suggestion of the Connecticut members; a final item of the compromise was that the senators should vote individually and not by States, so that a State should only have its power on condition of keeping its members in place. For the general functions of the House, and its relations present and prospective to the Senate, see Congress.

The members of the House, according to the Constitution, must be 25 years of age, seven years citizens of the United States and residents of the States which send them; by act of 25 June 1842 they must be chosen from districts formed of contiguous territory (but see Gerrymander for the observance of this). This put an end to electing on general ticket, but there is no provision that the representatives shall be residents of their districts, and the people have a perfect right to choose them from any part of the State. What prevents this is not law, but the intense local particularism which, even in State senatorial districts made up of several towns, insists on passing the office around among the towns; at bottom, the American conviction that public office demands no training. The number of members is fixed by Congress after each new census.

A quorum of members is a majority of those actually chosen. The House organizes by having the clerk of the last House call the new members to order, and if a quorum is present he calls the roll for a vote on choice of speaker. The members choose their seats in turn as their numbers are drawn by lot. The principal officers are the speaker, clerk, sergeant-at-arms, doorkeeper, postmaster and chaplain. (For the speaker's powers, see CONGRESS). The sergeant-at-arms is the constable. The symbol of his authority is the mace, made on the pattern ordered by the House 14 April 1789; a Roman device, ebony fasces, of which each rod ends in a spear-head, bound at the ends and in the middle with silver bands, and on the end a globe surmounted by an eagle with outspread wings. The House is governed by Jefferson's 'Manual of Parliamentary Practice,' plus its standing rules and orders and the joint rules of the two houses. Consult Beard, C. A., 'American Government and Politics' (New York 1910); Bryce, J., 'American Commonwealth' (4th ed., New York 1910); McLaughlin, A. C., and Hart, A. B., 'Cyclopedia of American Government' (New York 1914); Reinsch, P. S., 'American Legislatures and Legislative Methods' (New York 1907); Wilson, W., 'Congressional Government' (15th ed., New York 1900).

HOUSE OF THE SEVEN GABLES. A romance written by Nathaniel Hawthorne immediately after the 'Scarlet Letter' (q.v.) and published in 1852. The scene is laid in Salem, the author's native town, which he had quitted for a residence in western Massachusetts when his fellow townsmen became incensed over the personalities in the Introduction to the 'Scarlet Letter.' Something of the resentment shown in this unfortunate sketch is seen in the creation of Judge Pyncheon, the villain of 'The House of the Seven Gables,' who is said to have been drawn after the local politician whom Hawthorne held chiefly responsible for his removal from the Salem custom-house. Other materials in the tale which have a personal or family origin are the inherited curse of the Pyncheons, which was really invoked on an early Hawthorne who was one of the witch-judges, and the account of lost title-deeds to vast estates in Maine, which was one of the traditions in the family of the author's mother. The story involves the aristocratic Pyncheons, who own the house of the seven gables, and their humble fellow-townsmen, the Maules. Between these two families has existed a strange relationship since early colonial times when Matthew Maule pronounced a dying curse on his enemy, a Pyncheon who had brought about his condemnation as a wizard. The reader, however, cares far less for the plot which brings about the removal of the curse than for the treatment of characters and scenes, and the atmosphere which pervades the whole. There is an element of humor which is lacking in the 'Scarlet Letter' and no work of the author shows better his delicacy and subtlety. The portrayal of Hepzibah, the poverty-stricken but proud descendant of the Pyncheons, is masterly in its blending of sympathy and playfulness. While inferior to the 'Scarlet Letter' as a unified work, 'The House of the Seven Gables' is richer in passages that linger in the reader's memory, and is the romance of Hawthorne most frequently studied in schools and recommended for the reading of young persons.

WILLIAM B. CAIRNS.

HOUSE SNAKE, or MILK SNAKE, a variety of *Lampropeltis doliatus,* the corn-snake (q.v.) of the South, found abundantly in most parts of the northern half of the United States westward to the Rocky Mountains. The dorsal scales are not at all keeled and the ventral plates often exceed 200 in number; the ground-color is gray with three series of rounded black-bordered brown blotches, and the belly checkered with black and white; a length of four feet is sometimes attained. This is a handsome and mild-tempered colubroid snake, very abundant in farming districts, where it frequently enters houses, but probably in search of mice rather than for the purpose of drinking milk, as is popularly believed. It is an expert climber, often ascending porches and vines attached to the walls of houses. Usually the eggs are deposited in a hole dug in a sandy field.

HOUSE SPARROW, or ENGLISH SPARROW, the typical and most familiar sparrow of Europe (*Passer domesticus*), which has now become a cosmopolitan. Its original specific range cannot be determined, as from the first it has attached itself to civilized mankind, clustering about his cabins, settlements and cities, because it was naturally fearless, and still more because human occupations furnished it with an unfailing supply of food; and it spread northward and eastward as Roman civilization extended itself into the wilderness. Its hardiness, non-migratory habit and vast fecundity under the stimulation of a constant food-supply, have enabled it everywhere to thrive and to increase in numbers, until now it is probably the most numerous of any sort of land-bird in the world. Certainly it is, as a species, the most widely distributed, yet locally in the sense that it avoids uncultivated or thinly inhabited tracts. When colonies of Europeans, especially British, were formed in various countries, men missed the cheerful little companions of their paternal dooryards, and imported pairs into their new homes in India, Australia, New Zealand and elsewhere, principally from an impulse of sentiment. Meanwhile the bird had made its own way, apparently, across Asia to China and Japan.

This sparrow was introduced into the United States by the deliberate action of gentlemen connected with the Institute in Brooklyn, N. Y., and 50 pairs were set free in that city in the year 1850. Other importations speedily followed, and during the next 10 years colonies were established in Cincinnati, Saint Louis, San Francisco and other interior and western cities, on the theory that they would protect shade-trees from foliage-eating caterpillars. From these centres the adventurous sparrows spread rapidly, chiefly along the highways, "where the droppings of horses furnished an abundant supply of half-digested grain, and along the railways where the grain-cars were continually scattering food." It is now resident in all parts of the continent, as far north as agriculture extends, but is migratory in northern Canada in the time of winter snows. Everywhere it is most numerous in cities, flocking to the rural districts somewhat in autumn, and returning to town or village during the winter.

The natural food of the species consists of seeds, supplemented by buds, fruit and similar fare in season. Caterpillars, ants and other insects are taken, but mainly as food for fledglings. Hence these sparrows have not contributed in a greater degree than do our native fringilline species to the destruction of troublesome «worms.» On the contrary they have driven from gardens, villages and city parks, by their numbers and pugnacity, many gentler kinds of native birds that were better insect-catchers. This is true especially with reference to such birds as are willing to make their homes in nesting-boxes within gardens and parks, such as martins, barn-swallows, bluebirds and wrens, which the sparrows attack incessantly, tearing their nests to pieces to get materials for their own, and seizing on their quarters. They are destructive in gardens, also, eating young plants, pecking at all kinds of fruit and plucking off buds and flowers. They make a nuisance of themselves, also, by the construction in shade and ornamental trees, and among vines over porches and walls, of their big, ragged, globular nests, entered by a hole in the side; and often place these unsightly structures on buildings, or amid architectural decorations, and at the same time befoul the buildings with their droppings, and disturb the sleeping occupants by their noisy chirping. Moreover the nests and the birds themselves harbor and distribute vermin and disease-germs.

These noxious traits far overbalance any good these foreign sparrows do, and are a heavy cost to pay for the cheer of their presence in the streets of the large cities. In many circumstances repressive action is necessary, and the government not only refuses them the protection of law, but has issued directions for killing them by wholesale; but little can be accomplished toward ridding an estate or a village of the pest except by co-operative and concerted action, steadily continued, and this is hard to obtain.

Much has been written about this subject in ornithological and agricultural literature, including several special treatises, of which the most comprehensive is by W. B. Barrows, entitled ‘The English Sparrow in North America,’ published by the Department of Agriculture at Washington, in 1889, as Bulletin 1 of the Biological Survey.

Ernest Ingersoll.

HOUSEHOLD GODS. See Lares; Penates; Vesta.

HOUSEHOLD WORDS, a weekly magazine published by Charles Dickens, founded 30 March 1849. Many of the short stories of Dickens and contemporary authors appeared in its numbers. In 1858 it was discontinued and its patronage absorbed by *All the Year Round.*

HOUSELEEK, a genus of plants of the family *Crassulaceæ.* The leaves are of dark green, thick and spiny, growing in rosette-shaped clusters. The flower grows on a slender stalk and is pale-red and star-shaped. The leaves have the property of relieving pain caused by stings, burns, etc. See also Sedum.

HOUSING PROBLEM. See Tenement House.

HOUSMAN, Laurence, English author and illustrator: b. London, 18 July 1865. He has illustrated ‘The Goblin Market’; ‘Weird Tales’; ‘The Were Wolf’; ‘Jump to Glory Jane’; and other books, his work being mostly engraved on wood by his sister Clemence. His publications include ‘The Writings of William Blake’ (1893); ‘A Farm in Fairyland’ (1894); ‘The House of Joy’ (1895); ‘Gods and Their Makers’ (1897); ‘The Field of Clover’ (1898); ‘The Little Land’ (1899); ‘The Seven Young Goslings’ (1899); ‘Love Letters of an Englishwoman’ (1901), which appeared anonymously; ‘The Blue Moon’ (1904); ‘The Cloak of Friendship’ (1905); ‘Mendicant Rhymes’ (1906); ‘Selected Poems’ (1909); ‘Pains and Penalties’ (1911); ‘John of Jingalo’ (1912); ‘The Royal Runaway’ (1914), and ‘Jingalo in Revolt’ (1914); ‘The Return of Alcestis’ (1916).

HOUSSAYE, oo-sä', **Arsène,** French writer: b. Bruyères, 28 March 1815; d. 26 Feb. 1896. His family name was Housset. A few years after his arrival at Paris (1832), he published two interesting romantic novels, ‘La couronne de bluets’ and ‘La pécheresse’ (1836). He was a facile writer, producing works of equal merit in various literary forms and on many diverse subjects. They include ‘L'histoire de la peinture flamande et hollandaise’ (1846); ‘Mlle. de la Vallière et Mme. de Montespan’ (1860); ‘Galerie de portraits du XVIIe siècle’ (1844); ‘Histoire du quarante et unième fauteuil de l'academie française’ (1855), literary criticisms written with satirical poignancy; ‘Comédiennes’ (1857); ‘Symphonie des vingt ans’ (poetry, 1867); ‘Cent et un sonnets’ (1873) and numerous novels. From 1849–59 he was director of the Comédie Française, a post which he secured at the recommendation of Rachel. He was also editor of *L'Artiste* and of *La Presse.*

HOUSSAYE, Henri, ŏṅ-rē oo-sä', French historian: b. Paris, 24 Feb. 1848; d. 1911. He was educated at the Lycée Napoléon, fought with distinction in the Franco-German War, became an editor of the *Revues des Deux Mondes* and the *Journal des Debats,* and was chosen president of the Société des Gens de Lettres. In 1864 he obtained election to the French Academy, which in 1873 awarded the Thiers prize to his ‘Histoire d'Alcibiade.’ He published in three parts — ‘1814,’ and ‘1815’ (2 vols.) — a study of Napoleon's downfall, which enjoyed wide sale in France, and is considered one of the best extant works on the subject.

HOUSTON, hūs'tŏn, **David Franklin,** United States Secretary of Agriculture: b. Monroe, N. C., 17 Feb. 1866. He received his education at Harvard, where he took his M.A. in 1892. From 1887–88, he was tutor in ancient languages at the South Carolina College; and superintendent of city schools at Spartanburg, S. C. (1888–91), when he returned to Harvard to pursue advanced courses in political science. He was appointed associate professor in 1897, full professor of political science (1900–02), and dean of the faculty (1899–1902) of the University of Texas. He then resigned in order to accept the presidency of the Agricultural and Mechanical College of Texas, where he remained for three years; after which he

SAMUEL HOUSTON

returned to the University of Texas in the capacity of president. From 1908-16 he was chancellor of Washington University, Saint Louis, and was appointed in 1913, Secretary of Agriculture in the Cabinet of President Wilson. His published works include 'A Critical Study of Nullification in South Carolina' (1896).

HOUSTON, Edwin James, American electrical engineer: b. Alexandria, Va., 1847; d. 1914. He studied at the Central High School, Philadelphia, where he taught later in the departments of physical geography and natural philosophy. From there he was called to the chair of physics at Franklin Institute, and taught the same subject at the Medico-Chirurgical College. His fame rests on his research in regard to electric systems, in which field he was coinventor of the Thomson-Houston system of arc-lighting. He was a member of the United States Electrical Commission and chief electrician of the International Exposition at Philadelphia in 1884. He was president of the American Institute of Electrical Engineers (1893-95). He was the author of 'Elements of Physical Geography' (1878); 'Dictionary of Electrical Word Terms and Phrases' (1889); 'Arc Lighting' (1897); 'Electricity in Every Day Life' (3 vols., 1904); 'Arc Lighting' (revised, 1906); 'Wonder Book of Magnetism' (1908); 'The Land of Drought' (1910); 'Born an Electrician' (1912).

HOUSTON, Sam, American soldier and statesman: b. near Lexington, Va., 2 March 1793; d. Huntsville, Tex., 26 July 1863. In 1806, after the death of his father, the family moved to Tennessee. Some years later he left home, crossed the Tennessee River and took up his abode with the Indians, by whom he was kindly received, and with whom he lived after their own fashion for several years. Oolooteka, one of their chiefs, adopted him as his son. In 1811 he returned to his family, and to maintain himself opened a school. In 1813 he enlisted as a common soldier in the United States army, was soon promoted ensign and lieutenant and fought under General Jackson, who from then on became his admirer and friend, against the Indians at the battle of Tallapoosa, in March 1814. There he received a severe wound which gave him considerable trouble throughout his entire life. In November 1817 he was appointed Indian sub-agent to carry out the treaty with the Cherokees just ratified. In the following winter he conducted a delegation of Indians to Washington. On arriving he found that complaints had been made against him to the government on account of the zeal with which he had exerted himself to prevent the unlawful importation of African negroes through Florida, then a Spanish province, into the Southern States. He was acquitted of all blame, but conceiving himself to be ill treated he resigned his commission in the army, and returning to Tennessee settled in Nashville and began the study of law. In 1819 he was elected district attorney, and in 1821 was chosen major-general of militia. In 1823 he was elected to Congress, was re-elected in 1825, and in 1827 was chosen governor of Tennessee.

In January 1829 he married Miss Eliza Allen, member of a prominent Tennessee family. Three months later his wife left him for reasons unknown; he immediately resigned his office, separated from his family, and deserting civilization, went to Arkansas, where his former Indian friends, the Cherokees, had removed. He was kindly received and for years remained with the Indians. In 1832 he went to Texas and at the outbreak of the Mexican War (q.v.), was elected commander-in-chief of the Texan army.

After the massacre of the Alamo, the Mexican President-general, Santa Anna, was defeated by Houston at the battle of San Jacinto, 21 April 1836. Santa Anna was captured by the Texans and the independence of Texas was achieved. On 23 July a general election for President, Vice-President, and members of Congress of the republic of Texas was ordered to take place on the first Monday of the following September. Houston was solicited to be a candidate, but declined; but as the day of election approached the popular feeling in his favor became so manifest that he had no alternative but to accept. He was elected by a large majority, one of the other candidates being S. F. Austin (q.v.), and was inaugurated 22 Oct. 1836. One of his first acts was to liberate Santa Anna, who had been kept in captivity, and to send him to Washington to confer with the President of the United States. He next opened negotiations with the United States government for the annexation of Texas to the Union, but the measure encountered such strong opposition in the United States that it did not succeed till several years later. Houston was again elected as President of Texas in 1841.

Texas became one of the United States in 1845, and Houston and Rusk were the first senators sent to Washington. Houston was re-elected at the end of his term in 1853, and remained in the Senate till March 1859. Both during his service in the Senate and House of Representatives he distinguished himself by his powerful eloquence. As a senator he was opposed to the Kansas and Nebraska bill, against which he made one of his most elaborate speeches, in which he declared that the repeal of the Missouri Compromise was a flagrant breach of faith, which would involve the country in interminable agitation and difficulty. He was prominently mentioned in 1854 as a presidential candidate of the "Know-Nothing" party. He was elected governor of Texas 1 Aug. 1859, but was deposed for adherence to the Union in 1861. After that he retired to Huntsville, Tex. The city of Houston, Tex. (q.v.), was named in his honor. A statue of Houston by Ney is in the statuary hall of the Capitol at Washington. Consult Anon., 'The Life of Sam Houston, the Hunter, etc.' (Philadelphia 1866); Bradley, G. D., 'Winning the Southwest' (Chicago 1912); Bruce, H., 'Life of General Houston' (New York 1891); Bryan, G. S., 'Sam Houston' (New York 1917); Crane, W. C., 'Life and Select Literary Remains of Sam Houston' (Philadelphia 1884); Dyer, O., 'Great Senators of the United States: 40 Years Ago (1848-49)' (New York 1889); Elliott, S. B., 'Sam Houston' (Boston 1900); Lester, C. E., 'Sam Houston and His Republic' (New York 1846); Sabin, E. L., 'With Sam Houston in Texas' (Philadelphia 1916); United States, House of Representatives, 'Statues of Sam Houston and S. F. Austin, etc.' (in *United States, House Documents, 58th Con-*

gress, 3d Session, No. 474, Washington 1905); Williams, A. M., 'Sam Houston and the War of Independence in Texas' (Boston 1893).

HOUSTON, Tex., city and county-seat of Harris County, on the Houston Ship Channel and the Houston and Texas Central; Galveston, Harrisburg and San Antonio; Texas and New Orleans; Beaumont, Sour Lake and Western; Houston East and West Texas; International and Great Northern; Trinity and Brazos Valley; San Antonio and Aransas Pass; Gulf, Colorado and Santa Fé; Missouri, Kansas and Texas; Saint Louis, Brownsville and Mexico; Galveston, Houston and Henderson; Texas Transportation Company, Sugarland Railway, and Houston and Brazos Valley railroads, 48 miles northwest of Galveston. It is at the highest point in the State, permanently accessible by water from the Gulf of Mexico.

Transportation.— The Houston Ship Channel, formerly known as the Buffalo Bayou, which furnishes an outlet to the sea 50 miles distant, has been navigated from the earliest days of the city's history. The work of widening and deepening it at a total cost of $4,500,000, was completed in 1914, after considerable delay, and when half of the final appropriation of $2,500,000 necessary to finish the work, on the offer of the Harris County Navigation District, was accepted by the Federal government. It now admits of the passage of large ocean steamers, and the government stands pledged to maintain it forever. The ship channel has been the greatest factor in the development of the city. Its banks offer excellent sites for industrial enterprises, which can acquire the ownership of their wharves and warehouses, and many large manufacturing plants are already fixed there, including those of the Houston Packing Company, The Texas Company, Bayou City Compress, Density Cotton Yard, International Press, Magnolia Compress and Warehouse Company, Merchants Compress Company, Shippers Compress Company, Standard Compress Company, R. R. Dancy & Co., Merchants and Planters Oil Company, Nelms-Kehoe Cotton Dock Company, Armour Fertilizer Company, Calhoun Pattern, Foundry and Machine Company, Fidelity Chemical Corporation, Houston Lighting and Power Company Houston Gas and Fuel Company, Pritchard Rice Mills, Galena Oil Refinery, Sinclair Oil Refinery, Universal Shipbuilding Company, Midland Bridge Company, Houston-Humble Oil Company Refinery, Pacific Chemical Company, Gulf Refining Company (mixing plant), Peden Iron and Steel Company, Schuhmacher Grocery Company, Farmers Oil Company, Texas Portland Cement Company. Regular steamship service has been established between Houston, Philadelphia and New York City, and also with Tampa, Fla., Tampico, Mexico, and other points, and the completion of the Intercoastal Canal further facilitates transportation. Houston is also the great railroad centre of the Southwest and the headquarters of the larger lines as listed above.

Industries.— Being the centre of a rich lumber and agricultural region, it is the distributing point of most of the raw material of the State, and the largest inland port cotton market in the world. Its extensive cotton plants handle over 1,000,000 bales annually, and over 3,000,000 bales are marketed through Houston. It is the headquarters of 23 oil corporations and 47 lumber corporations, and has important rice mills, cotton-seed oil and sugar refineries, lard factories, fertilizing plants, etc., making a total of 369 factories turning out 283 different articles with an approximate value of $63,000,000.

Banks.— There are six national banks, two State banks and six trust companies, with a combined capital of $9,000,000. The combined deposits in November 1918 amounted to $53,210,821.

Buildings.— Houston has more skyscrapers than any other city of equal population. Prominent among these are the Texas Oil Company building (costing $1,000,000), the Union National Bank, the Kress, Mason and Foster buildings. Among the principal edifices are the city hall (with new annex), the city auditorium (costing $400,000), the Carnegie library and Houston Lyceum, union station, the market, City Hospital, Cotton Exchange, United States government building, South End Junior High School (costing $325,500) and Rice Institute.

Bridges and Parks.— Sixteen bridges span the ship channel and smaller streams of the city, 10 of which are concrete; the largest, the Main street viaduct, was built in 1912, at a cost of $555,375. The park area of the city is over 800 acres, 409 acres having been donated in 1914 by Mr. G. H. Hermann.

Education.— Houston has exceptional educational facilities. It is the seat of the Rice Institute, the largest educational institution in the South, founded by the late William M. Rice in 1892 as a free coeducational institution of liberal and technical learning. The original endowment of $5,000,000 has been increased to over $10,500,000, and it was opened for students in 1912. The property covers 100 acres; six of the proposed 33 buildings are completed. The city has, besides, 23 public schools — three of which are high schools for the whites and 12 (one high school) for colored, with a combined building valuation of $1,415,050 and equipment valuation of $144,225. Saint Agnes Academy is the most important of several Catholic educational institutions, and there are a number of private schools. There are 34 churches of all denominations for whites, and 29 for colored, besides missions, chapels and numerous charitable institutions.

Government, etc.— In 1905 Houston adopted the commission form of government, vested in a mayor and four commissioners, chosen from the city at large every two years. The municipality owns and operates the waterworks which are abundantly supplied by artesian wells. The city has a sinking fund of $1,452,315.94 in 1917. Its total expenses in 1916 amounted to $3,290,900, of which $551,380 was expended for schools; $86,204 for the water department; $178,068 for the fire department; $223,592 for the street and bridge department. In 1914 the area of the city was increased from 16 to 32 square miles. The total assessed valuation of lands, improvements and personal property was $143,000,000.

History.— Houston was settled shortly after the battle of San Jacinto, which was fought on 21 April 1836, within a few miles of its location. It was named after Gen. Sam Houston (q.v.), was incorporated in 1837 and until

1840 was the seat of government for the republic of Texas. Pop. 153,192.

JAMES Z. GEORGE,
General Manager, Houston Chamber of Commerce.

HOUTMAN, hout'mạn, **Cornelis,** Dutch traveler: b. Gouda, middle of 16th century; d. 1599. He is said to have been the founder of the East Indian trade. He journeyed in a trading vessel to Lisbon in 1593, where he suffered imprisonment. On his release he became interested in the routes to the East and was successful in organizing an expedition of four ships which set forth in 1595. His route led him around the Cape of Good Hope, through the Strait of Sunda to the south coast of Java, and thence returned to his native country, two years later. The importance of this discovery of an accessible route to the Spice Islands resulted in the formation of the Dutch East India Company. Houtman made other voyages over the same passage and was killed by the natives of Achin.

HOUTMAN, Frederik, brother of the preceding: b. 1570; d. 1627. He accompanied his brother on his various expeditions as navigator of the fleet. He suffered capture by the natives of Achin in 1598, purchased his freedom and eventually found his way back to Holland in 1601. Two years later he undertook another voyage to the East Indies and was appointed governor of Amboyna in 1605. In 1618 he was given a similar post in the Moluccas and in 1625 received a gold medal from the government in recognition of his services to Dutch trade. Houtman was also a noted linguist, publishing a grammatical dictionary of Malay and Madagascar. An edition of this work as a grammar and dictionary of Malay and Dutch appeared in 1680. The citizens of Gouda erected bronze statues to Frederik and Cornelis Houtman in 1880.

HOVE, hōv, England, a municipal borough in Sussex, England, on the English Channel, near Brighton, on the London, Brighton and South Coast Railway. The great seawall of Brighton extends along the Hove front and forms an attractive promenade. There are fine walks, hotels, public buildings, library and municipal baths. The Sussex County cricket ground is stationed here. The municipal borough was incorporated in 1898, the government being vested in a mayor, 10 aldermen and 30 councillors. Pop. 37,000.

HOVEDEN, hŭv'dĕn or hōv'dĕn, or **HOWDEN, Roger of,** an English chronicler: b. probably at Howden, Yorkshire; d. about 1201. He served as clerk at the court of Henry II, was itinerant justice for Cumberland, Northumberland and Yorkshire. His fame rests chiefly on his 'Cronica,' a record beginning with the year 732 and ends with 1201. It was edited by Bishop Stubbs (4 vols., 1868–71). A modern translation appeared by Riley at London, 1853, in the 'Bohn Library.'

HOVELACQUE, ōv'-läk, **Alexandre Abel,** French anthropologist: b. Paris, 1843; d. 1896. He is known chiefly as one of the founders of the Ecole d'Anthropologie, where he was professor of linguistic ethnography, and director in 1890, succeeding Gavarret. He was also active in politics and was elected mayor of Paris in 1888. He published 'Mélanges des linguistique et d'anthropologie' (1889); 'Les races humaines' (with Emile Picot and Julien Vinson 1882), and 'Précis d'anthropologie' (with G. Hervé, 1887). He was also one of the founders of the *Revue de Linguistique.*

HOVENDEN, Thomas, American genre painter: b. Dunmanway, in County Cork, Ireland, 28 Dec. 1840; d. Norristown, Pa., 14 Aug. 1895. He studied at Cork, at the South Kensington art schools and after his emigration to the United States in 1863 at the National Academy of Design, New York. A few years were also spent in France, where he studied under Cabanel at Paris, and devoted much of his time to a study of peasant types in Brittany. On his return to the United States he became a member of the National Academy in 1882. His principal works are 'The Last Moments of John Brown' (Metropolitan Museum); 'Breaking Home Ties,' a popular work, depicting an American farm lad leaving home to seek his fortune in the city; 'News from the Conscript'; 'A Brittany Woman Spinning'; 'Loyalist Peasant Soldier of La Vendée'; 'A Breton Interior' (1793), and 'Jerusalem the Golden.'

HOVEY, Alvin Peterson, American soldier: b. near Mount Vernon, Ind., 6 Sept. 1821; d. Indianapolis, 23 Nov. 1891. He taught school by day and at night studied law, and was admitted to the bar in 1843; was appointed successively circuit judge, judge of the Supreme Court and United States district attorney. In 1846, at the outbreak of the Mexican War, he enlisted in the Indiana volunteers, but saw no active service. He was colonel of the 24th regiment of Indiana volunteers, and afterward major-general during the Civil War. He went through the Vicksburg campaign under Grant who thought very highly of him. In 1864 he was made commander of Indiana. He was Minister to Peru; was elected to Congress in 1886, and became governor of Indiana in 1888. Consult Johnson, R. U., and Buel, C. C., 'Battles and Leaders of the Civil War' (4 vols., New York 1884); Walker, C. M., 'Hovey and Chase' (Indianapolis 1888).

HOVEY, Charles Mason, American horticulturist: b. Cambridge, Mass., 26 Oct. 1810; d. Boston, 2 Sept. 1887. He was the first to introduce a pistillate strawberry, known as "The Hovey," a variety that marks the beginning of strawberry culture in the United States. He edited the *Magazine of Horticulture* for many years, and was the author of 'Fruits of America' (2 vols., 1880).

HOVEY, Edmund Otis, American geologist: b. New Haven, Conn., 15 Sept. 1862. He was educated at Yale University, receiving his doctor's degree in 1889. In 1890 he studied at the University of Heidelberg, and on his return to the United States became principal and superintendent of schools at Janesville, Minn. (1884–85); of Elk River, Minn. (1885–86). From 1886–87 he was assistant at the mineralogical laboratory of the Sheffield Scientific School, and served also as principal there from 1891–92. At the Chicago Exposition he had charge of the Missouri mineral exhibit. In 1894 he entered the employ of the geological department of the American Museum of Natural History, serving first as assistant, and finally becoming curator in 1910. He assisted on the United States Geological Survey in 1890 and in 1901–06. His publications include 'Martinique and St. Vincent' (1902); 'The 1902–03 Eruptions of Mont Pelée, Martinique and the Soufrière, St. Vincent.'

HOVEY, Richard, American poet: b. Normal, Ill., 4 May 1864; d. New York, 24 Feb. 1900. He was graduated at Dartmouth 1885, studied theology for a year, but soon went abroad and led a bohemian life, being in turn actor, journalist, dramatist and poet, and finally lecturer on English literature in Barnard College, New York. His verse was of the idealistic school and marked with the influence of Ibsen and Maeterlinck. His works are 'Launcelot and Guenevere'; 'Taliesin: a Masque' (1900); 'Seaward: an Elgy' (1893); 'The Laurel' (1897); 'Along the Trail' (1898). A collected edition of these were published in 1907 (New York). His poems were collected in two volumes: 'Along the Trail' (New York 1898), and 'To the End of the Trail' (edited by Mrs. R. Hovey, New York 1908). Together with Bliss Carman (q.v.) he wrote 'Songs from Vagabondia' (New York 1893); 'More Songs from Vagabondia' (New York 1896), and 'Last Songs from Vagabondia' (New York 1900). He also translated 'The Plays of Maurice Maeterlinck' (2 vols., Chicago 1902). Consult Aide, H., 'Richard Hovey' (in *Nineteenth Century,* Vol. XXXV, p. 240, London 1894); Hale, E. E., Jr., 'Launcelot and Guenevere' (in *Dial,* Vol. XXVI, p. 17, Chicago 1899); Knorr, H., 'Richard Hovey's Promise and Work' (in *Poet-Lore,* Vol. XII, p. 436, Boston 1900); Page, C. H., 'Plays and Poems of Richard Hovey' (in *Bookman,* Vol. VIII, pp. 360 and 449, New York 1898–99); Rittenhouse, J. B., 'Younger American Poets' (New York 1900); Ward, L., 'Richard Hovey' (in *Harvard Monthly,* Vol. XXXI, p. 111, Cambridge 1901).

HOW, William Walsham, English prelate: b. Shrewsbury, 13 Dec. 1823; d. 10 Aug. 1897. He received his education at Oxford and became rector of Whittington in Shropshire, where he worked for 30 years. In 1879 he was appointed suffragan bishop of Bedford, and in the following year bishop of Wakefield. He was exceedingly active in church revival work in the East End, founding a philanthropic fund and extending his efforts along social lines. In 1888 he became bishop of Wakefield. Bishop How wrote a number of popular hymns, religious poems and sermons, and also a 'Commentary on the Four Gospels,' 'Manual for the Holy Communion'; 'Private Life and Ministration of a Parish Priest' (1873); 'Commentary upon St. John' (1879), and 'The Papal Claims in the Light of Scriptural History' (1881).

HOWARD, Blanche Willis. See Teuffel, Blanche Willis Howard, Baroness Von.

HOWARD, Bronson, American playwright: b. Detroit, Mich., 7 Oct. 1842; d. 1908. Preparing for college he turned to journalism instead of entering Yale, and from 1867 to 1872 was employed on the New York *Tribune, Evening Mail* and other newspapers. In 1864 he had written a dramatic piece called 'Fantine,' which was produced in Detroit, but his first important play was 'Saratoga,' produced by Augustin Daly in 1870, and the first of a long list of successes, which gave him a foremost position among American playwrights. Among his plays are 'The Banker's Daughter' (1878); 'Young Mrs. Winthrop' (1882); 'The Henrietta' and 'Met by Chance' (1887); 'Shenandoah' (1889); 'Aristocracy' (1892); 'Peter Stuyvesant' (with Brander Matthews), etc.

HOWARD, George Elliott, American educator: b. Saratoga, N. Y., 1849. He was graduated at Nebraska University (1876), spent a year at the universities of Munich and Paris, and returned to Nebraska as professor of history (1879–91). He occupied a similar position at Leland Stanford Junior University (1891–1901); was at Cornell, giving a special course in history (1902), and lectured at the University of Chicago (1903–04). In the last-mentioned year he resumed his work at the University of Nebraska as professor of institutional history, and later filled the chair of political science and sociology (1906). From 1885–91 he was secretary of the Nebraska State Historical Society. He has written 'Local Constitutional History of the United States' (1889); 'Development of the King's Peace' (1891); 'History of Matrimonial Institutions, chiefly in England and the United States' (1904); 'Preliminaries of the American Revolution' (1905); 'Social Control and the Function of the Family, in Congress of Arts and Science' (Vol. VII, 1906). He has contributed many articles to encyclopedias on history, social science and institutional history.

HOWARD, Henry. See Surrey, Earl of.

HOWARD, Jacob Merritt, American legislator: b. Shaftsbury, Vt., 1805; d. 1871. After studying at Williams College he prepared himself for a legal career and took up practice in Detroit, Mich. In 1838 he was elected to the State legislature, and two years later sat in Congress in the Whig party. He devoted much of his time and interest to the Whig campaigns, and was one of the organizers of the new Republican party. He served as attorney-general of the State for three terms. In 1862 he was appointed United States senator to the vacancy occurring on the death of Senator Bingham, and was re-elected in 1864. He published in translation the 'Secret Memoirs of the Empress Josephine' (1847).

HOWARD, John, English philanthropist: b. probably Hackney, 2 Sept. 1726; d. Kherson, Russia, 20 Jan. 1790. From 1742–70 he made repeated journeys to the Continent. In 1756 he became a member of the Royal Society. In 1773 he was appointed high sheriff of Bedfordshire, when the subject of prison discipline came under his notice; and finding many abuses in the management of jails, he resolved to devote his time to investigation of the means of correcting them. With this view he visited most of the English county jails and houses of correction, and in March 1774 laid the result of his inquiries before the House of Commons. This resulted in the passage of a number of bills improving prison conditions in England to a considerable extent. From 1775–80 he again traveled extensively, inspecting prisons in France, the Low Countries, Germany, Switzerland, Austria and Italy. In 1781 and 1782 he made a tour through the northern parts of Europe, including Denmark, Sweden, Russia and Poland. In 1783 he visited Spain and Portugal, and again surveyed the prisons of his own country. At the same time was published a complete edition of his 'State of the Prisons in England and Wales, etc.,' which had been published first in 1777, but was now enlarged by considerable supplementary matter. A new subject now engaged his attention, namely, the management of lazarettos, and the means of preventing the communication of the plague and other contagious diseases. In 1789 he published 'Account of the Principal Lazarettos in Europe.' In 1789 he proceeded through Germany to Saint Petersburg and Moscow. Prisons and hospitals were everywhere thrown open for his inspection as a friendly monitor and public benefactor. While in Russia he died of camp-fever. A statue by Bacon was erected to his memory in Saint Paul's, London. Consult Aikin, J., 'A View of the Life and Philanthropic Labours of the Late John Howard' (Boston 1794); Anon., 'Anecdotes of the Life and Character of John Howard' (London 1790); Brown, J. B., 'Memoirs of the Public and Private Life of John Howard' (London 1818); Dixon, W. H., 'John Howard and the Prison World of Europe' (New York 1850); Field, J., 'The Life of John Howard, etc.' (London 1850); id., 'John Howard's Correspondence' (London 1855); Guy, W. A., '1773; or John Howard, Sheriff of Bedford' (London 1873); id., 'John Howard's Winter's Journey' (London 1882); Taylor, T., 'Memoirs of John Howard' (London 1836); Stoughton, J., 'Howard, the Philanthropist' (London 1884).

HOWARD, John Eager, American soldier: b. Baltimore County, Md., 4 June 1752; d. «Belvedere,» near Baltimore, 12 Oct. 1827. He joined the army under Washington at Middlebrook, N. J., in the spring of 1777, and subsequently fought at Germantown and Monmouth. In 1780 he joined the troops in North Carolina under Greene, and in the battle of Cowpens (1781) he displayed great gallantry, and the bayonet charge of the Maryland troops under his command, whereby the enemy were thrown into confusion, turned the fortune of the day and secured victory to the Americans. For his services in this battle he received from Congress a silver medal. He was severely wounded at the battle of Eutaw. In 1787–88 he was a member of the Continental Congress. In 1787 he married Margaret, the daughter of Benjamin Chew (q.v.) of Germantown. In 1788 was elected governor of Maryland, a position which he filled for three years. From 1796 to 1803 he represented Maryland in the United States Senate. He was an unsuccessful candidate for the Vice-Presidency in 1816. Much of his former property in Maryland County is now covered by the streets and houses of Baltimore, in which city his name has been given to streets, parks, etc. In 1904 an equestrian statue by the French sculptor, Frémiet, was erected in his memory by the Municipal Art Society of Baltimore. Consult Anon., 'John Eager Howard' (in *National Portrait Gallery,* Vol. II, New York 1835); Municipal Art Society of Baltimore, 'Frémiet's Howard,' (Baltimore 1904); Read, E., 'John Eager Howard' (in *Magazine of American History,* Vol. VII, p. 276, New York 1881).

HOWARD, John Galen, American architect: b. Chalmsford, Mass., 8 May 1864. He spent three years at the Massachusetts Institute of Technology; then studied with private architects and finally entered the Ecole des Beaux Arts, Paris, where he remained for three years. Among his designs are the Hotel Renaissance, the Hotel Essex and several Park buildings in New York; the high school at Newark, N. J.; the Majestic Theatre, Boston; the public library, Montclair, N. J., and the Electric Tower at the Pan-American Exposition, Buffalo. Since 1901 he has been professor of architecture and supervising architect at the University of California, and since 1913 director of the School of Architecture. A number of the university buildings, as well as the Greek theatre, were designed by Howard. After the San Francisco earthquake, he became an advisory member of the reconstruction committee; and was later appointed one of the chief architects of the Alaska-Yukon-Pacific Exposition (1909). Since 1912 he has been a member of the board of consulting architects of San Francisco.

HOWARD, Katharine, fifth queen of Henry VIII (q.v.): b. about 1520; d. 13 Feb. 1542. She was the daughter of Lord Edmund Howard, a granddaughter of Thomas Howard, second Duke of Norfolk, and a niece of Thomas Howard, third Duke of Norfolk. She was also a cousin of Anne Boleyn, second queen of Henry VIII. Married privately to Henry VIII at Oatlands in July 1540, she was publicly acknowledged as queen soon afterward. In November 1541 she was accused of misconduct previous to her marriage and thrown into prison. Released in December, new evidence was uncovered, apparently showing that she had betrayed the king even after her marriage. She was again imprisoned and beheaded in the Tower. Her story has been dramatized by Alexander Dumas the Elder in 'Catherine Howard,' first played in Paris in 1834 and adapted into English by W. D. Suter (in 'Lacy's Acting Edition of Plays,' Vol. XXXVII, London n. d.); and by the German poet Rudolf von Gottschall, in 'Katharine Howard'; it also forms part of the novel by L. Muehlbach, 'Henry VIII and his Court' (English trans., New York 1864). Consult Brenan, G., and Statham, E. P., 'The House of Howard' (2 vols., London 1907); Fronde, J. A., 'The Reign of Henry VIII' (3 vols., New York 1908); Herbert, H. W., 'Memoirs of Henry VIII, etc.' (New York 1855); Hume, M., 'The Wives of Henry VIII' (London 1905); Reville, A., 'Le Roi Henri VIII et ses Femmes' (in *Revue Politique et Littéraire,* Series V, Vol. VI, p. 805, Paris 1906); Strickland, A., 'Lives of the Queens of England' (Vol. III, London 1877).

HOWARD, Leland Ossian, American entomologist: b. Rockford, Ill., 11 June 1857. He studied at Cornell University, and later took graduate work at Georgetown University, District of Columbia. He was assistant entomologist, and later became chief, of the Bureau of Entomology (1894), a position which he still occupies. He was appointed honorary curator of the department of insects in the United States National Museum (1895); and consulting entomologist in the United States Public Health

Service (1904). In 1917 he was made member of the committee on agriculture of the National Council of Defense. From 1900–05, he was a trustee of Cornell University. For many years he was editor of *Insect Life*, and collaborated in the Century and Standard Dictionaries. He lectured also at Swarthmore College and the Post-Graduate School of Georgetown University. Dr. Howard is the author of ‘Mosquitoes — How They Live’ (1901); ‘The Insect Book’ (1902); ‘The House Fly — Disease Carrier’ (1911); ‘Mosquitoes of North America’ (1912) and also many government publications.

HOWARD, Oliver Otis, American general: b. Leeds, Me., 8 Nov. 1830; d. 1909. He was graduated from Bowdoin in 1850, and from West Point in 1854. He was then assigned to the ordnance department of the regular army, served in Florida against the Seminoles and was professor of mathematics at West Point 1857–61. At the outbreak of the Civil War he entered the volunteer service as colonel of the 3d Maine regiment. He was in over 20 important battles; in 1861 he was at the battle of Bull Run, and was afterward made brigadier-general of volunteers; in 1862 he served in the Virginia campaign, and at the battle of Fair Oaks lost his right arm. He commanded at the battles of Antietam and Fredericksburg; in 1863 was appointed to the command of the 11th Army corps and led them at the battles of Chancellorsville and Gettysburg. When the 11th corps was united with the 12th he was given the command of the 4th corps of the Army of the Cumberland, but was shortly afterward transferred to the command of the Army of the Tennessee, which was the right wing of Sherman's army on his «march to the sea.» In 1864 he was appointed brigadier-general in the regular army, and in 1865 made commissioner of the Freedmen's Bureau; 1869–73 he was president of Howard University (q.v.), established in Washington for the higher education of the negro. In 1874 he was placed in command of the Department of the Columbia, and there conducted four campaigns against the Indians, including that against the Nez Percés tribe. In 1881 he was superintendent at West Point, and subsequently in command of the Departments of the Platte and of California; in 1886 he was promoted to the rank of major-general and assigned to the Department of the East, where he remained until his retirement in 1894. In 1895 he founded the Lincoln Memorial University, Cumberland Gap, Tenn. He wrote ‘Donald's School Days’ (1879); ‘Chief Joseph, or the Nez Percés in Peace and War’ (1881); ‘General Zachary Taylor’ (1892); ‘Isabella of Castile’ (1894); ‘Fighting for Humanity’ (1898), and ‘Henry on the War’ (1898). Consult ‘Autobiography of O. O. Howard’ (2d ed., 2 vols., New York 1907).

HOWARD, Thomas Benton, United States naval officer: b. Galena, Ill., 10 Aug. 1854. He was graduated at the United States Naval Academy (1873), and saw service at the battle of Manila Bay, where he was navigator of the *Concord*. He rose through successive ranks to rear-admiral (1910). In that year, he was placed in command of the fourth division of the Atlantic fleet; of the third division in 1912, and in 1912–13 was president of the Naval Examining and Retiring Board. He was retired in 1916; and in 1917 was appointed superintendent of the United States Naval Observatory. For some time Rear-Admiral Howard was instructor in mathematics at Annapolis; later taught applied mathematics and physics and chemistry, and was head of the department of ordnance and gunnery.

HOWARD, William Schley, American legislator: b. Kirkwood, Ga., 29 Jan. 1875. He received an academic education, was admitted to the bar in 1895 and has since practised his profession at Decatur, Ga. In 1899 he was elected to the Georgia house of representatives and subsequently was solicitor-general of the Stone Mountain judical circuit from 1905 to 1910. He was elected to Congress in 1911, and was subsequently re-elected several times. During the Spanish-American War he served in the 3d Georgia Volunteer Infantry.

HOWARD, Kan., city in Elk County, on the Elk River, 76 miles south of Emporia, on the Atchison, Topeka and Santa Fé Railroad. The principal industries are agriculture and stock-raising. The city owns and operates its gas and electric-light plants. Pop. 1,175.

HOWARD COLLEGE, a Baptist institution of learning at Birmingham, Ala., founded in 1841. Its faculty numbers 20; the average annual attendance of students is 220. The tuition fees are $75; living expenses, board, etc., $150; the productive funds amount to $97,000; the total income, including tuition and incidental charges, is $38,024. The college colors are crimson-blue. The library contains over 20,000 volumes.

HOWARD UNIVERSITY, a coeducational institution in Washington, D. C., was chartered by the United States government in 1867. It was named for Gen. O. O. Howard, who was head of the Freedmen's Bureau and had much to do with the founding of the university. It has the following departments with the standard courses: College of Arts and Sciences, Teachers College, School of Medicine with its Medical College, Dental College and Pharmaceutic College, School of Law, School of Theology (undenominational), School of Manual Arts and Applied Sciences, Conservatory of Music, Library School, Commercial College and Academy. Total faculty 111, students 1,452 from 35 States and six foreign countries. Annual income for all purposes $204,000, about one-half of which comes from an appropriation of the United States government. Productive endowment $309,018; value of grounds $615,692, buildings $551,924, academic library $32,700, law library $8,000, equipment: medical laboratories $34,744; academic laboratories $11,457, manual arts and applied sciences $22,912, other equipment $29,707. This university has done a very large work in training teachers, physicians, ministers and other leaders of the colored race in the western hemisphere.

HOWE, Albion Paris, American artillery officer: b. Standish, Me., 1818; d. 1897. After receiving training at West Point he was assigned to the 4th Artillery. He returned to West Point in 1843 as mathematical instructor until the outbreak of the Mexican War, where he distinguished himself in active service. He became a captain in 1855, and when the Civil War began was appointed chief of artillery

ELIAS HOWE

Inventor of the Sewing Machine

under General McClellan during the 1861 campaign. He fought in the Peninsular campaign, commanding a light artillery brigade in the Army of the Potomac. In 1862 he was appointed brigadier-general of volunteers and served in Couch's division in the 4th Army corps. From 1864–66 he was in command of the artillery depot at Washington, and at the close of the war (1865), he was brevetted major-general in the regular army. In 1882 he retired from the service.

HOWE, Andrew Jackson, American eclectic surgeon and author: b. Paxton, Mass., 14 April 1825; d. Cincinnati, Ohio, 16 Jan. 1892. He was educated at Leicester Academy and Harvard College, from which he graduated in 1853. He then attended medical lectures at Jefferson Medical College, Philadelphia; College of Physicians and Surgeons and the New York Medical College of New York City, and Worcester Medical Institute, graduating from the latter in 1855. He was demonstrator of anatomy in his alma mater in 1855–56; professor of anatomy and surgery in Cincinnati College of Eclectic Medicine and Surgery, 1856–59; demonstrator and professor of anatomy in Eclectic Medical Institute of Cincinnati, 1859–61; professor in same of surgery, from 1861 to 1892. He wrote ‹A Treatise on Fractures and Dislocations› (1873); ‹Manual of Eye Surgery› (1874); ‹Art and Science of Surgery› (1876); ‹Operative Gynæcology› (1890); ‹Conversations on Animal Life› and ‹Miscellaneous Papers,› published in 1894, after his death. He was assistant editor of and a frequent contributor to the *Eclectic Medical Journal.* His chief interest outside of his own profession was the study of comparative anatomy; he left his large collection of preparations and drawings to the Cincinnati Natural History Society of which he was a very active member. His great scholarship and equally great ability as a lecturer and speaker made him a highly successful medical teacher, just as his skill as an operator made him one of the foremost surgeons of his day. He was president of the National Eclectic Medical Association in 1882–83.

HOWE, Edgar Watson, American novelist and editor: b. Treaty, Ind., 3 May 1854. At the age of 12 he entered a printing office, and when only 19 was publisher of the *Golden Globe* in Golden, Colo. Ten years later he became proprietor and editor of the Atchison (Kan.) *Daily Globe.* In 1883 appeared ‹The Story of a Country Town,› which attracted considerable attention; this was followed by ‹The Mystery of the Locks›; ‹A Moonlight Boy›; ‹A Man Story›; ‹An Ante-Mortem Statement›; ‹The Confession of John Whitlock›; ‹Daily Notes of a Trip Around the World›; ‹Travel Letters from New Zealand, Australia and Africa›; ‹The Trip to the West Indies›; ‹Country Town Sayings›; ‹The Hundred Stories of a Country Town›; ‹Pagan Psalms,› etc.

HOWE, Elias, Junior, American inventor: b. Spencer, Mass., 9 July 1819; d. Brooklyn, N. Y., 3 Oct. 1867. He lived with his father, who was both farmer and miller, till 1836, working upon the farm and in the mill and attending the district school during the winters. He then learned the trade of a machinist, and experimented in inventing a sewing-machine. The model was completed in 1845 and the patent issued 10 Sept. 1846. A patent was also taken out in England, but from this the inventor realized nothing. After constructing four machines in the United States, he visited England in 1847, where he sold one of his machines with all his English rights for $1,250 to a corset manufacturer. He returned to Boston after two years entirely destitute, and resumed his trade for the support of his family. From this period until 1854 he was involved in expensive lawsuits, when the principal infringers of his patents acknowledged his rights, and arranged to manufacture sewing-machines under licenses from him from which he finally derived considerable wealth. His patent was renewed in 1860 for seven years. Upon its second expiration in 1867, the inventor refused an offer of another renewal. He served as a private in the 17th Connecticut Volunteers during the Civil War. After the war he founded a sewing-machine plant in Bridgeport, Conn. He was the recipient of the Legion of Honor cross and many medals. Consult Anon., ‹Elias Howe› (in *Practical Magazine,* Vol. V, p. 321, London 1875); Gifford, G., ‹Argument, etc., for an Extension of E. Howe, Jr.'s Patent, etc.› (New York 1860); Holland, R. S., ‹Historic Inventions› (Philadelphia 1911); Hubert, P. G., Jr., ‹Inventors› (New York 1893); Iles, G., ‹Leading American Inventors› (New York 1912); Koehler, W., ‹Die Deutsche Nähmaschinen Industrie› (Munich 1913); Neuburger, A., ‹Erfinder und Erfindungen› (Berlin 1913); Roe, A. S.; ‹Elias Howe› (in *New England Magazine,* n. s., Vol. XXXI, p. 356, Boston 1904); Talbot, F. A., ‹All about Inventions and Discoveries› (New York 1916).

HOWE, Frederic Clemson, American lawyer: b. Meadville, Pa., 21 Nov. 1867. He studied at Allegheny College, Pa., and at Johns Hopkins. Later he went to Germany, where he pursued advanced courses at Halle University, and on his return to the United States prepared for the legal profession at the University of Maryland and the New York Law School. From 1894–1909 he practised at Cleveland. In 1911 he became director of the People's Institute in New York city, and three years later became commissioner of immigration, port of New York, which office he still holds. In 1905 was United States commissioner to investigate municipal ownership in Great Britain. He held important offices at Cleveland; sat in the Ohio senate (1906–09); during which time he also was professor of law at the Cleveland College of Law; lecturer on taxation at Western Reserve University, and lecturer on municipal administration and politics at the University of Wisconsin. Dr. Howe is the author of ‹Taxation and Taxes in the United States Under the Internal Revenue System 1791–1895›; ‹The City — The Hope of Democracy›; ‹The British City — The Beginnings of Democracy› (1907); ‹Privilege and Democracy in America› (1910); ‹Wisconsin: An Experiment in Democracy›; European Cities at Work›; ‹Socialized Germany› (1915); ‹Why War?› (1916); ‹The High Cost of Living› (1916).

HOWE, Henry Marion, American metallurgist: b. Boston 2 March 1848. He is the son of Julia Ward Howe, and brother of Laura

Elizabeth Richards. He received his education at Harvard, and at the Massachusetts Institute of Technology (1871). He became professor of metallurgy at Columbia University (1897), and after having taught there for a number of years was retired as professor emeritus. Dr. Howe has been the recipient of medals from the Franklin Institute of Philadelphia, from the British Iron and Steel Institute and the gold medal of the Verein zur Beförderung des Gewerbfleisses. In 1893 he was elected president of the American Institute of Mining Engineers, and in 1912 president of the International Association for Testing Materials. His publications include ‘Copper Smelting’ (1885); ‘Metallurgy of Steel’ (1890–1904); ‘Metallurgical Laboratory Notes’ (1902); ‘Iron, Steel and Other Alloys’ (1903–06); ‘Metallography of Steel and Cast Iron’ (1916).

HOWE, John, English Puritan divine: b. Loughborough, Leicestershire, 17 May 1630; d. London, 2 April 1705. He was educated at Christ's College, Cambridge, and Magdalen College, Oxford, of which latter he was a Fellow and chaplain. About 1654 he was appointed perpetual curate of Great Torrington, Devonshire; in 1657 Cromwell appointed him as his domestic chaplain. As such he served until Richard Cromwell's deposition in 1659. During his absence from Great Torrington various substitutes acted in his place amongst whom was Increase Mather (q.v.). He was frequently styled «The Platonic Puritan» and is ranked as the greatest of the Puritan clergymen. He was an eloquent preacher and a powerful controversialist, but fortunately free from animosity or theological bitterness. He was a prolific writer. His works were collected and published in various editions (in 2 vols., 1724; in 8 vols., 1822; in 1 vol., 1838; in 3 vols., 1848; in 6 vols., 1862–63). Amongst them have been especially valued ‘A Treatise on the Blessedness of the Righteous, etc.’ (1668); ‘A Treatise of Delighting in God, etc.’ (1674); ‘The Living Temple of God’ (1675); ‘A Second Part of the Living Temple of God’ (1702). All editions of his works contain a life of the author, of which the most important is that by E. Calamy, prefixed to the edition of 1724. Consult Gordon, A., ‘John Howe’ (in *Dictionary of National Biography,* Vol. XXVIII, London 1891); Horton, R. F., ‘John Howe’ (London 1895); Miller, S., ‘Works of John Howe’ (in *Princeton Biblical Repertory and Theological Review,* n. s. Vol. III, p. 177, Philadelphia 1831); Rogers, H., ‘The Life and Character of John Howe, etc.’ (London 1836 and 1863).

HOWE, John Ireland, American inventor: b. Ridgefield, Conn., 20 July 1793; d. Birmingham, Conn., 10 Sept. 1876. He studied medicine and practised his profession for a number of years. In 1828 he patented a process for making a rubber compound, but was unsuccessful in his attempt to utilize his invention commercially. In 1830 he invented a pin-making machine for which he secured a patent in 1832. After building a more perfect machine in 1833 he secured patents also in France, England, Scotland and Ireland. In 1835 he established the Howe Manufacturing Company, first in New York, and later in Birmingham, Conn., of which he was general manager for some 30 years. His first machines were perfected later by utilizing the inventions of Fowler and Piper, and soon became the means of revolutionizing the pin manufacture.

HOWE, Joseph, Canadian journalist, orator and statesman: b. North West Arm, Halifax, 13 Dec. 1804; d. Halifax, 1 June 1873. He was the son of John Howe, a United Empire Loyalist, the deputy postmaster-general of Nova Scotia and founder of the *Weekly Chronicle.* He learned the art of printing in his father's office, contributed his first poem to the *Acadian Magazine* in 1826, and in 1827 acquired the *Novascotian,* to which he contributed a remarkable series of articles descriptive of rambles in the province and in whose hands it was destined to become the potent instrument of liberal reforms. A trenchant attack on the magistrates of Halifax in 1835 led to his prosecution for libel, when he defended his own case, was triumphantly acquitted and «found himself» as an orator. The following year he was elected to the assembly for Halifax County. In 1833 he visited England, and was influential in the establishment of the mail steam service with Halifax that was the beginning of the Cunard Line. He became a member of the executive council in 1840, and speaker of the assembly in 1841, both of which offices he resigned in 1843 to take up the editorship of the *Morning Chronicle.* He was provincial secretary 1848–54, and in the latter year he was appointed commissioner of the provincial railway board. He undertook a recruiting campaign for the British army in the United States in 1855, and the same year was defeated by Dr. Charles Tupper in Cumberland County. In 1862 he resigned from the assembly on his appointment as fishery commissioner. When in 1864 Confederation became a burning question, Howe threw all the weight of his authority and influence against the scheme, visited England to oppose the passing of the British North America Act, and after Confederation had become an accomplished fact, swept the province in both provincial and federal sections for repeal. After fighting on for a time, he bowed to the inevitable, secured better financial terms in the federal bargain for his native province and accepted office in the Macdonald government, first as president of the council and, 1869–73, Secretary of State for the provinces. His acceptance of office was liable to misconstruction by his opponents and it lost him popularity in his native province to which he returned as lieutenant-governor, but had held office for only a few weeks when he died. His death provoked a revolution of feeling in Nova Scotia and was the occasion of great public sorrow. He had won the battle of self-government; he thought imperially; he had been associated with all the great and far-reaching enterprises of his time. In the greatest crisis of his life, when he turned his back on his past utterances and took the field against Confederation, he was less than true to himself. But in the influence he wielded by his pen, in his powers as an orator to sway the hearts of the people, in his personal magnetism and dynamic force, in his rare combination of statesman's grasp and insight with prophetic vision, he is the most remarkable figure in the public life of any British colony and «stands out like a splash of scarlet on the drab background of Canadian politics.» Consult An-

JULIA WARD HOWE

nand's ‘Speeches and Letters of Joseph Howe’ (Chisholm's ed., 1909), and Longley's ‘Joseph Howe.’

HOWE, Julia Ward, American author and philanthropist: b. New York, 27 May 1819; d. Middletown, R. I., 17 Oct. 1910. She was carefully educated and in 1843 she married S. G. Howe (q.v.) of Boston and immediately became active in philanthropical work. Their home quickly became a centre of the best intellects of Boston. With her husband she edited the *Boston Commonwealth*, one of the ablest anti-slavery papers, to which she contributed leading articles, essays, poems, etc. At the same time she also wrote for the New York *Tribune* and the *Anti-Slavery Standard*. She also was editor of the *Woman's Journal*. After the Civil War she was active as writer and speaker in social and philanthropic work, particularly in the agitation for woman's suffrage and for prison reform. She was one of the founders and for many years president of the New England Women's Club, the first organization of its kind in America; she was also one of the organizers and for a number of years president of the Association for the Advancement of Women; she was delegate to the World's Prison Reform Congress in London (1872) and at that time founded the Women's Peace Association, being an ardent believer in international peace; and was president of the women's branch of the New Orleans Exposition (1885). She preached occasionally in Unitarian pulpits and was president of the Boston Authors' Club from its foundation in 1899. Her writings include ‘Passion Flowers’ (1854); ‘Words for the Hour’ (1856); ‘The World's Own’ (1857); ‘Later Lyrics’ (1866); ‘A Trip to Cuba’ (1860) and ‘From the Oak to the Olive’ (1868), two books of travel; ‘The World's Own’ (1855), a drama; ‘Sex and Education’ (1874); ‘Modern Society’ (1881); ‘Is Polite Society Polite?’ (1895); ‘Life of Margaret Fuller’ (1883); ‘From Sunset Ridge’ (1898); and ‘Reminiscences’ (1899). Her best-known poem is ‘The Battle Hymn of the Republic’ (in ‘Later Lyrics’), written early in the Civil War, while she was visiting the camps around Washington. It was set to the music of ‘John Brown's Body,’ and immediately became popular with the soldiers. As a writer she was best in her lyrical poems, most of which show a strong religious feeling. As a speaker she was successful as much by the strength and clearness of her arguments as by her eloquence. She kept her mental and to a great extent her physical abilities up to within a very short time of her death and throughout the many years of her active life was a strong power for the advancement of women and the improvement of mankind. Consult Adams, E. C., and Foster, W. D., ‘Heroines of Modern Progress’ (New York 1913); Boston, Mass., City Council, ‘Memorial Exercises in Honor of Julia Ward Howe’ (Boston 1911); Chapman, J. J., ‘Memories and Milestones’ (New York 1915); Elliott, M. H., ‘The Eleventh Hour in the Life of J. W. Howe’ (Boston 1911); Hall, F. H., ed., ‘Julia Ward Howe and the Woman Suffrage Movement, etc.’ (Boston 1913); id., ‘The Story of the Battle Hymn of the Republic’ (New York 1916); Higginson, T. W., ‘Julia Ward Howe’ (in ‘Carlyle's Laugh and Other Surprises,’ p. 285, Boston 1909); Richards, L. E., and Elliott, M. H., ‘Julia Ward Howe’ (2 vols., Boston 1915); Stedman, E. C., ‘Julia Ward Howe’ (in ‘Genius and Other Essays,’ p. 254, New York 1911); Townsend, H. A., ‘Reminiscences of Famous Women’ (Buffalo 1916).

HOWE, Mark Antony de Wolfe, American editor and author: b. Bristol, R. I., 28 Aug. 1864. He was educated at Lehigh and Harvard universities and on leaving college entered the editorial office of *The Youth's Companion*, Boston. In 1893–95 he was assistant editor of the *Atlantic Monthly*, and from 1899 to 1913 was corresponding editor of *The Youth's Companion*. Since 1913 he has been editor of the *Harvard Alumni Bulletin*. He has published ‘Shadows,’ verse (1897); ‘American Bookmen’ (1898); ‘The Memory of Lincoln’ (edited) (1899); ‘Phillips Brooks’ (1899); ‘Boston: the Place and the People’ (1903); ‘Life and Letters of George Bancroft’ (1908); ‘Harmonies, A Book of Verse’ (1909); ‘Home Letters of General Sherman’ (edited) (1909); ‘Boston Common: Scenes from Four Centuries’ (1910); ‘Life and Labors of Bishop Hare, Apostle to the Sioux’ (1911); ‘Lines of Battle and Other Poems, by Henry Howard Brownell’ (edited) (1912); ‘Letters of Charles Eliot Norton’ (with Sara Norton) (1913); ‘The Boston Symphony Orchestra’ (1914). He edited the series of ‘Beacon Biographies’ from 1899 (31 vols.).

HOWE, Richard, Earl Howe, English admiral: b. London, 8 March 1726; d. 5 Aug. 1799. At 14 he shipped as a midshipman on board the *Severn*, in which he sailed with Anson for the Pacific, and passed through the usual gradations of the service under that admiral till 1745, when he obtained the command of the *Baltimore* sloop-of-war, in which he took part in the siege of Fort William during the last Jacobite rebellion. In 1756 he served in the Channel fleet; in 1758 reduced Cherbourg. In 1759 he defeated a French squadron under Conflans, and for two years (1763–65) occupied a seat in the Board of Admiralty. In 1776, as commander-in-chief in North America, he acted against the American forces and against D'Estaing, who commanded a superior French fleet. He sailed to the relief of Gibraltar in 1782 and was successful in spite of the combined fleets of France and Spain, and was rewarded with a British peerage. On the outbreak of war with France in 1793 he took the command of the British fleet, and on 1 June 1794 obtained a decisive victory off Ushant for which he received the thanks of Parliament. He was made admiral of the fleet in 1796. His name is one of the highest among those of the famous naval commanders of Great Britain. He greatly improved the service by the introduction of a new system of tactics and perfected the signaling code. Consult the ‘Life’ by Barrow (1838).

HOWE, Robert, American colonial soldier: b. Brunswick County, N. C., 1732; d. there, 12 Nov. 1785. He was a member of the assembly and of two provincial congresses and took a prominent part in the preparation for the Revolution. At the outbreak of the war he was given a command and aided in driving the British out of Virginia; was promoted to the rank of major-general and commanded in the South. In 1778 he was repulsed by the British and compelled to evacuate Savannah; though then deprived of command he was afterward acquitted by the court-martial by which he was tried for the loss of the city. In 1780 he commanded at Charleston; in 1783 assisted Washington in putting down a mutiny; and in 1785 was elected to the North Carolina legislature, but died before he took his seat.

HOWE, Samuel Gridley, American philanthropist: b. Boston, 10 Nov. 1801; d. there, 9 Jan. 1876. He was graduated from Brown University in 1821, which later gave him the honorary degree of LL.D., and from the Harvard Medical School in 1824. Immediately after completing his studies he joined the Greek army at the time of the war for independence; he created an excellent surgical corps for the Greeks and was also distinguished as a brave commander in battle; at the declaration of peace he established an industrial colony of Greeks on the Isthmus of Corinth. He returned to the United States for a short time and collected a sum of money, supplies of food and clothing which he personally distributed in Greece, keeping thereby many hardships from Greek women and children. He then again returned to America, but becoming interested in the work for the blind, went back to Europe in order to study the schools for the blind there; while in Paris he was chairman of the committee for the relief of the Poles in the time of the Polish uprising; he went to Prussia to distribute the funds collected and was imprisoned by the Prussian authorities for five months. In 1832 he returned to Boston and with the assistance of Colonel Perkins and some other friends founded the Perkins Institution for the Blind, of which he became superintendent; in this position he did much to improve the methods in the instruction of the blind; he gradually built up the Howe Press for printing books in raised type, and as early as 1841–42 an edition of the Holy Bible in eight volumes was prepared under his direction in raised type. He was, though extremely modest in his personal relations, a powerful and convincing speaker and by untiring work and continuous effort did much to induce the legislatures of many States to found schools similar to the Perkins Institution. His greatest success was in the training of Laura Bridgman, a deaf, mute and blind little girl. He also assisted in organizing the Massachusetts School for Idiots. He was active in the anti-slavery cause; was candidate of the Conscience Whig Party for Congress, but was defeated; and was editor of the anti-slavery paper, the *Boston Commonwealth*, assisted by his wife, Julia Ward Howe (q.v.). At the close of the Civil War he joined in the work of the Freedmen's Bureau (q.v.). He was always active in many lines of philanthropic work, organized the Massachusetts State Board of Charities, as chairman of which he served 1864–74, and went to Greece in 1867 with supplies for the Cretans. In 1870 he was one of the commission appointed by President Grant to visit Santo Domingo and report upon the advisability of its annexation. He wrote 'Historical Sketch of Greek Revolution' (1828); 'Reader for the Blind' (1839); 'Appeal to the People of the United States, to Relieve from Starvation the Women and Children of the Greeks of the Island of Crete' (1867). His many reports in his capacity as chairman and director of several boards and institutions are distinguished by their remarkable clarity and vision, as much as by their thoroughness and humaneness. Consult Elliott, W. H., and Hall, F. M. H., 'Laura Bridgman, etc.' (Boston 1903); Holmes, O. W., 'A Memorial Tribute to S. G. Howe' (in *Atlantic Monthly*, Vol. XXXVII, p. 464, Boston 1876).; Howe, J. W., 'Memoir of Dr. S. G. Howe' (Boston 1876); Perkins Institution, Boston, 'Proceedings at the Celebration of the One Hundredth Anniversary of the Birth of S. G. Howe' (Boston 1902); Richards, L. E., ed., 'Letters and Journals of S. G. Howe' (2 vols., Boston 1906–09); Sanborn, F. B., 'Dr. S. G. Howe, the Philanthropist' (New York 1891); Stearns, F. P., 'Chevalier Howe' (in 'Cambridge Sketches,' p. 218, Philadelphia 1905).

HOWE, Timothy Otis, American statesman: b. Livermore, Me., 24 Feb. 1816; d. Kenosha, Wis., 25 March 1883. He received a common school education, studied law, was admitted to the bar and sat in the Maine legislature in 1845. He removed in that year to Green Bay, Wis., entered politics, and in 1861 was chosen United States senator, serving till 1879. He declined a Supreme Court judgeship on the death of Salmon Chase, but in 1881, after serving as delegate to the International Monetary Conference at Paris, became Postmaster-General in President Arthur's Cabinet. During his administration of this department, which continued until his death, the postage rate was reduced and various other reforms were instituted.

HOWE, Sir William, English general: b. 10 Aug. 1729; d. 12 July 1814. He was educated at Eton and received a commission in the Duke of Cumberland's Light Dragoons in 1746. In 1772 he was promoted major-general, lieutenant-general in 1775 and a full general in 1793. He was a brother of Admiral Lord Richard Howe (q.v.) and was appointed rather against his wishes successor of General Gage in command of the British forces in America. He had previously served under Wolfe at the battle of Quebec. He also took part in the campaign against Havana in 1762. He commanded at the battle of Bunker Hill (1775), in which he lost one-third of his men present in the action; in August 1776 he won the battle of Long Island and in September took New York city. He won the battle of Brandywine in September 1777, in consequence of which Philadelphia was occupied by his army. At his own request he was recalled in 1779, and was succeeded by Sir Henry Clinton, who repulsed Washington at Germantown in the October following. After his return, he represented Nottingham in the House of Commons and held various military commands in England. At his request his conduct of the war, which had been severely criticized, was investigated by a committee of the House before which he spoke at considerable length in his own and his brother's defense. He succeeded to his brother's Irish peerage as fifth viscount in 1799. In 1805 he was appointed governor of Plymouth, which post he held until his death. Consult Howe, Sir W., 'The Narrative of Lieut. Gen. Sir W. Howe in a Committee of the House of Commons, etc.' (London 1780); Stevens, B. F., ed., 'Gen. Sir W. Howe's Orderly Book, 1775–76, etc.' (London 1890); Tower, C., 'Essays Political and Historical’ (Philadelphia 1914); Wilkin, W. H., ‘Some British Soldiers in America’ (London 1914).

HOWELL, Clark, American journalist and legislator: b. Barnwell County, S. C., 21 Sept. 1863. Graduating from the University of Georgia in 1883, he engaged in journalism, became managing editor in 1889, editor-in-chief in 1897 and eventually general manager and controlling owner of the *Atlanta Constitution.* He was elected a member of the Georgia house of representatives in 1887, and speaker of the house 1890–91. He was a member of and president of the Georgia senate 1900–05; has been a member of the Democratic National Committee from Georgia since 1894; and a member of the board of directors of the Associated Press since 1900.

HOWELL, John Adams, American naval officer: b. Bath, N. Y., 16 March 1840; d. 10 Jan. 1918. He was graduated from the United States Naval Academy in 1858, and rose by successive ranks to lieutenant-commander (1865). His rise thereafter was consistent: he became commander (1872); captain (1884); commodore (1895); and rear-admiral (1898). He was in charge of the navy yard at Washington in 1893–96, and of the yard at League Island (1896–98). In 1898 he commanded the European squadron and the Northern Patrol squadron. From 1898–1902, he was president of the Naval Examining and Retiring Board, and retired in the last-mentioned year. Mr. Howell was an inventor of considerable repute, patenting a fly-wheel torpedo, a disappearing gun carriage, an amphibious vehicle and a gyroscopic steering torpedo.

HOWELL, Mich., city, county-seat of Livingston County, on the Pere Marquette and the Ann Arbor railroads, 50 miles northwest of Detroit. It is located in a rich agricultural section of the State. The chief manufactures are flour and condensed milk; and it has manufactures of plows, pumps, condensed milk, flour, etc. Pop. 2,338.

HOWELLS, William Dean, American novelist, poet and critic: b. Martin's Ferry, Ohio, 1 March 1837. During his boyhood his father owned and published daily papers in Hamilton and Dayton, Ohio, successively, and he learned the printer's trade and gradually the whole business of conducting a newspaper. In 1851 he was working in Columbus as a compositor; in 1856 he became Columbus correspondent of the Cincinnati *Gazette;* and in 1859 was appointed news editor of the *Ohio State Journal.* At this time he published a small volume of poems, and also some poems in the *Atlantic Monthly.* In 1860, when Lincoln was nominated, Howells wrote his life, and in 1861 was appointed United States consul at Venice, where he remained till 1865. The impressions of his stay there were embodied in ‘Venetian Life’ (1866), and ‘Italian Journeys’ (1867). On his return to the United States he was for a time connected with the staff of the New York *Times* and the *Nation.* In 1866 he became assistant editor of the *Atlantic Monthly,* and editor-in-chief in 1872. In 1886–92 he conducted the critical department of *Harper's Monthly* called «The Editor's Study»; in 1892 was editor of the *Cosmopolitan* for a short time, and since then has been the writer of the ‘Editor's Easy Chair’ in *Harper's Magazine.* Since 1901 he has received the degree of doctor of letters from Oxford, Yale, Columbia and Princeton universities and LL.D. from Adelbert College, and from its foundation in 1909 has been president of the American Academy of Arts and Letters.

His first novel, ‘Their Wedding Journey,’ was published in 1871; his other novels include ‘A Chance Acquaintance’ (1874); ‘A Foregone Conclusion’ (1875); ‘The Lady of the Aroostook’ (1879); ‘The Undiscovered Country’ (1880); ‘Doctor Breen's Practice’ (1882); ‘A Modern Instance’ (1882); ‘A Woman's Reason’ (1883); ‘The Rise of Silas Lapham’ (1885); ‘Indian Summer’ (1886); ‘The Minister's Charge’ (1886); ‘April Hopes’ (1887); ‘A Hazard of New Fortunes’ (1889); ‘The Shadow of a Dream’ (1890); ‘An Imperative Duty’ (1892); ‘The Quality of Mercy’ (1892); ‘The World of Chance’ (1893); ‘The Coast of Bohemia’ (1893); ‘A Traveller from Altruria’ (1894); ‘The Landlord at Lion's Head’ (1897); ‘An Open-Eyed Conspiracy’ (1898); ‘The Story of a Play’ (1898); ‘Ragged Lady’ (1899); and ‘Their Silver Wedding Journey’ (1900). Howells has also written farces and comedies, including ‘The Sleeping-Car’ (1883); ‘The Mouse-Trap’ (1897); ‘The Unexpected Guests’ (1898); and ‘The Albany Depot’ (1898), etc., and the following volumes of verse: ‘Poems of Two Friends’ (1860), with J. J. Piatt; ‘No Love Lost, a Romance of Travel’ (1868), and ‘Poems’ (1873). His other works include ‘Tuscan Cities’ (1885); ‘Modern Italian Poets’; ‘Essays and Versions’ (1887); ‘Criticism and Fiction’ (1891), and ‘Impressions and Experiences’ (1896); ‘Literary Friends and Acquaintances’ (1899), and ‘Heroines of Fiction’; ‘A Pair of Patient Lovers’; ‘The Kentons’; ‘Literature and Life’; ‘The Flight of Pony Baker’ (1902); ‘Questionable Shapes’ (1903); ‘Miss Bellard's Inspiration’ (1905); ‘London Films’ (1905); ‘Certain Delightful English Towns’ (1906); ‘Between the Dark and the Daylight’ (1907); ‘Through the Eye of the Needle’; ‘Fennel and Rue’; ‘The Mother and the Father’; ‘Seven English Cities’; ‘New Leaf Mills’ (1913); ‘The Seen and Unseen at Stratford-on Avon’ (1914); ‘Years of My Youth’ (1915); ‘The Daughter of the Storage’ (1916); ‘The Leatherwood God’ (1916). He edited ‘Choice Autobiographies with Essays’ (8 vols.) and ‘Library of Universal Adventure.’ In 1915 he was awarded the gold medal of the National Institute of Arts and Letters «for distinguished work in fiction.»

In American literature Howells is the leader of the realistic school; his novels portray the average, everyday American life; he has a true and sympathetic understanding of the «common people» of the United States, and types of the American «self-made» man appear and reappear in his stories. His latest phase, that in which he seeks to understand and set forth the American social problems,— the meaning of socialism, the relations of labor and capital, and, more broadly, the mystery of poverty and of human suffering,— is typified in a book like ‘A Hazard of New Fortunes’; and ‘A Traveller from Altruria,’ a picture of an ideal commonwealth. The absence of idealism in Howells' writings has been cited as their gravest and compelled to evacuate Savannah; though then deprived of command he was afterward acquitted by the court-martial by which he was tried for the loss of the city. In 1780 he commanded at Charleston; in 1783 assisted Washington in putting down a mutiny; and in 1785 was elected to the North Carolina legislature, but died before he took his seat.

HOWE, Samuel Gridley, American philanthropist: b. Boston, 10 Nov. 1801; d. ther 9 Jan. 1876. He was graduated from Br University in 1821, which later gave hi honorary degree of LL.D., and from th vard Medical School in 1824. Imr after completing his studies he jc Greek army at the time of the wa pendence; he created an excell corps for the Greeks and was alsc as a brave commander in battle tion of peace he established an of Greeks on the Isthmus o turned to the United Stat and collected a sum of m and clothing which he Greece, keeping ther Greek women and c turned to Americ the work for th in order to s there; while committee time of t sia to impris mon wir sc

profes- of California in professor on Analytic of Evolution' contributed to God' (1897).

Henry Lycurgus, American 10 Oct. 1837; d. He was graduated from the Naval Academy in 1858. He important engagements during becoming lieutenant-com- In 1899 he became rear- was retired 19 Oct. 1899.

HOWITT, William and Mary, English au- commonly named together; the one pub- works and the other over 100. WILLIAM (b. Heanor, Derbyshire, 18 Dec. 1792; d. Rome, Italy, 3 March 1879), showed such a bias literature that he published verses at 13. In 1821 he married MARY BOTHAM (b. Coleford, Staffordshire, 12 March 1799; d. Rome, 30 Jan. 1888), who wrote both by herself and with her husband. Their first joint work, a volume of poems, 'The Forest Minstrel,' was published in 1823, and 1827 appeared 'The Desolation of Eyam.' The best lines in these are by Mrs. Howitt, Howitt himself having no great poetic gift. In 1871, however, he published a volume entitled 'The Mad War Planet and Other Poems.' William and Mary Howitt settled first in Staffordshire. In 1823 they removed to Nottingham, where they resided till 1837, and in 1840 visited Germany, where they resided for three years. Results of their residence in Germany appeared in 'Student Life of Germany' (1841) and 'Rural and Domestic Life of Germany' (1842), which being translated into German acquired flattering popularity. While at Heidelberg Mrs. Howitt set herself to translate the tales of Frederika Bremer into English, and later the works of Hans Andersen. Their most ambitious work is 'The Literature and Romance of the North' (1852). Howitt's best works are those in which English history and life are treated in connection with English scenery. The earliest of these was the 'Book of the Seasons' (1831), which acquired great popularity; 'Rural Life in England' (1838) was also well received. Still others are 'Visits to Remarkable Places' (1840); 'Homes and Haunts of the British Poets' (1847); 'The Year Book of the Country' (1850), and 'The Northern Heights of London' (1869). With chairman and direct on 'The Ruined institutions are di at Britain.' Mrs. able clarity ar people were long thoroughnes States, and 'The Pet W. H., a other unpretending verses etc.' (T familiar to thousands of mori Consult the 'Life' by *M* (1889).

HOWITZER. See GUNS.

HOWLAND, SIR William Pearce, Cana- statesman: b. Pawling, N. Y., 1811; d. At the age of 19 he emigrated to Upper Canada and settled in York County, where he engaged in business, and later established a wholesale trade at Toronto. His political enthusiasms led him to support the Liberal party, and in 1857 he was elected a member of the Canada legislative assembly. Under the Macdonald-Sicotte administration he was Minister of Finance (1862–63), and under the Macdonald-Dorion, Receiver-General (1863–64). He was appointed Postmaster-General under the coalition government, and again Minister of Finance. With A. T. Galt he represented Canada in the reciprocity negotiations with the United States (1865); and was a delegate at the London conference at which the terms of the British North America Act were adopted. He sat in the first Parliament under the new Dominion (1867); and was also Minister of Inland Revenue. Sir Howland served for one term as lieutenant-governor of Ontario (1868–73), and in 1879 was knighted.

HOWLEY, Michael Francis, Newfoundland ecclesiastic: b. Saint John's, Newfoundland, 25 Sept. 1843; d. 15 Oct. 1914. After preliminary studies at Saint Bonaventure's he entered the Propaganda at Rome as a student for the priesthood, and was ordained in 1868. After service in Scotland and at Rome, he returned to his native land, and for the remainder of his life worked with great success in its spiritual interests. He became bishop of Saint George's, West Newfoundland, in 1892 — the first Newfoundlander to attain the dignity of the episcopate — was translated to Saint John's in 1894 and raised to the dignity of archbishop in 1904. Archbishop Howley was not only distinguished as a theological student and thinker, a devoted missionary and able preacher, but also as linguist, poet and antiquary. He contributed largely to the historical study of Newfoundland (q.v.), and is the author of 'The Ecclesiastical History of Newfoundland' (1888).

HOWORTH, how'ĕrth, SIR **Henry Hoyle,** English author and politician: b. Lisbon, Portugal, 1 July 1842. He was a Conservative member of Parliament for South Salford 1886–1900. In recognition of his works on Eastern history and other subjects, he was created K. C. I. E. in 1892. Besides very many scientific memoirs, he published 'History of the Mongols' (2 vols., 1876–78); 'The Mammoth and the Flood' (1887); 'The Glacial Nightmare and the Flood' (1905); 'Saint Gregory the Great' (1912); 'Saint Augustine of Canterbury' (1913); 'The Golden Days of the Early English Church' (1916).

HOWRAH, how'rā, India, an independent municipality, opposite Calcutta (q.v.), and its most important suburb. Pop. about 179,000.

HOWTH, hōth, Ireland, a seaside town of nty Dublin, situated on the side of the th promontory, on the north shore of Dub- v, nine miles northeast of Dublin, with t is connected by the Great Northern and by street cars. There is an arti- or used chiefly by smaller craft. In- d buildings are the picturesque col- h, dating from the 13th century, ancient castle with valuable his- Howth is a popular watering about 1,200.

E, Vinnie Ream, American sculp- Madison, Wis., 23 Sept. 1846; d. 20 1914. She was educated at Christian Col- ege, Columbia, Mo., and going to Washington, D. C., studied art, executed busts of Grant, Sherman and others, and a statue of Lincoln for the National Capitol, while still an art student, having won in competition a $30,000 prize for the statue of the martyred President. She then went abroad, where she designed medallions of Doré, Liszt, Buchanan, Read and others. Among other works of hers are ideal statues of 'Sappho'; 'The Spirit of the Carnival'; and the statue of Admiral Farragut in Farragut Square, Washington. She was married in 1878 to Maj. R. L. Hoxie of United States Engineers.

HOY, one of the Orkney Islands, Scotland, the second in size, in lat. 58° 50′ N., long. 3° 20′ W. It is about 13½ miles long and from six to eight miles wide. It has an excellent harbor, Long Hope, which is four miles long. A striking feature of the island is its steep red and yellow sandstone cliffs which rise abruptly from the sea to a height of some 1,300 feet. Pop. about 1,200. See ORKNEY ISLANDS.

HOYLAND NETHER, England, an urban district in the Hallamshire parliamentary division of the West Riding of Yorkshire. It is about six miles southeast of Barnsley, with which it is connected by the Midland Railway. It has extensive coal mines and manufactures bricks.

HOYLE, Edmond, English writer on games: b. 1672; d. London, 29 Aug. 1769. It is said that he was educated for the law, but nothing definite is known of his career except that he was for many years in London a writer on and instructor in games. His 'Short Treatise on Whist' (1742), a compendium of the laws of the game and many rules for play, sold largely and has been the basis of all subsequent manuals of the kind. So generally has his authority been accepted in the game that "according to Hoyle" has attained a proverbial significance.

HOYT, Arthur Stephen, American clergyman: b. Meridian, N. Y., 3 June 1851. He was graduated at Hamilton College and the Auburn Theological Seminary. From 1872–75 he was tutor at Robert College, Constantinople, Turkey, and on his return was ordained in the Presbyterian ministry. He was pastor at Oregon, Ill., from 1879–86; when he became professor of English literature and public speaking at Hamilton College. Since 1891 he has been professor of homiletics and sociology at Auburn Theological Seminary. His published works include 'The Work of Preaching' (1906); 'The Preachers' (1909); 'Public Worship for Non-Liturgical Churches' (1911); 'The Vital Elements of Preaching' (1914).

HOYT, Henry Martyn, American lawyer and soldier: b. Kingston, Pa., 8 June 1830; d. Wilkesbarre, Pa., 1 Dec. 1892. He was educated at Wyoming Seminary and Lafayette College and graduated from Williams College in 1849, taught school 1849–52, read law, was admitted to the bar in 1853, practised at Wilkesbarre, at the opening of the Civil War was appointed lieutenant-colonel of 52d Pennsylvania regiment, which he helped to raise, served during the Peninsular campaign in 1862, and was captured in a night attack on Fort Johnson during the siege of Morris Island. Exchanged and mustered out with the grade of brevet brigadier-general; he practised his profession until 1867, and was then appointed additional law-judge of the Lucerne County courts. In 1879–83 he was Republican governor of Pennsylvania. His administration was particularly characterized by a wise financial policy, by means of which the State debt was reduced to $10,000,000 and refunded at 3 per cent. He published 'The Controversy between Connecticut and Pennsylvania' (Harrisburg 1879); 'Protection *versus* Free-Trade' (New York 1885). He held honorary degrees from the University of Pennsylvania and Lafayette College. Consult Anon., 'H. M. Hoyt' (in 'A Biographical Album of Prominent Pennsylvanians,' Series I, p. 125, Philadelphia 1888).

HOYT, John Wesley, American educator: b. near Worthington, Ohio, 13 Oct. 1832; d. 23 May 1912. He was graduated at Ohio, Wesleyan University in 1849, and later studied both medicine and law. He had charge of educational exhibits in several international expositions, and was made chairman of the National Committee to Promote the Establishment of the University of the United States. He was the first president of the University of Wyoming, and was governor of Wyoming 1878–83. He published 'Progress of University Education' (1869); 'Studies in Civil Service' (1878); 'History of University Education' (1903), etc.

HOZIER, Pierre d', SEIGNEUR DE LA GARDE, French genealogist: b. Marseilles, 10 July 1592; d. Paris, 1 Dec. 1660. He acquired a prodigious knowledge of the histories of principal families and of heraldry, and in 1616 began genealogical researches. In 1628 the king honored him with the Order of Saint Michel and pensioned him in the following year. He soon rose to the position of royal histographer and genealogist of France (1634); and in 1641, *juge d'armes* of the kingdom. For several years thereafter he was occupied in tracing the descent of the pages of the king's household. In 1654 he was made Councillor of State. His principal work was in the collection of documents, but he published a number of works also, including 'Receuil armorial des anciennes maisons de Bretagne' (1638); 'Les noms, surnoms, qualitez armes et blasons des chevaliers et officers de l'ordre du Saint-Esprit' (1634); and the genealogies of the houses of La Rochefoucauld (1654); Bournonville (1657); and Amanzé (1659). His genealogies of the principal families of France which comprised the collection numbered about 150. After his death, they were deposited in the Bibliothèque Nationale. Two sons survived: LOUIS ROGER,

b. 1634; d. 1708. He succeeded his father as *juge d'armes*, but became blind in 1675 and the office fell to the younger brother, Charles René d', b. 1640; d. 1732. He made a splendid collection of armorial bearings, which was the foundation of the Armorial Général de France. His collection is in the Bibliothèque Nationale, and comprises 34 volumes of text and 35 of colored armorial bearings. The entries number some 60,000. His nephew, Louis Pierre, became his heir and also succeeded to the office of *juge d'armes*. He published an unofficial 'Armorial général, ou registre de la noblesse de France' (1738–68). Other descendants of the family continued in similar work. Ambrose Louis Marie (b. 1764; d. 1846) was the last *juge d'armes* of France.

HRABANUS MAURUS. See Rabames Maurus.

HRDLIČKA, dlich'ka, **Ales**, American anthropologist: b. Humpoletz, Bohemia, 30 March 1869. After a preliminary education in Bohemia he emigrated to the United States and undertook studies at the Eclectic College and the Homeopathic College. His work led him to undertake special research among the insane and defectives, from which studies he became interested in physical anthropology. From 1896–99 he was associate in anthropology at the New York State Pathological Institute. He spent some time also in Europe studying at the University of Paris and making extensive investigations in criminal and defective institutions. For many years he has been associated with the American Museum of Natural History, where he conducted expeditions in anthropological research in various parts of the United States, Mexico, Peru, South America, Egypt, the Balkans, Europe, Siberia, Russia and Mongolia. He holds the theory that the American aborigines are of Asiatic origin. Since 1910 he has been curator of the American Museum, in the department of physical anthropology. Hrdlička is a member of various distinguished American and foreign societies devoted to this subject and was associate editor of the *American Naturalist*. He has written 'Report on Anthropological Work in the State Institution for Feeble-Minded Children, Syracuse, N. Y.' (1898); 'Anthropological Investigations on One Thousand White and Colored Children' (1899); 'The Eskimo Brain' (1901); 'Ancient Man in North America' (1907); 'Tuberculosis Among Indians' (1909); 'Observations on Eskimo' (1910); 'Ancient Man in South America' (1912); 'Anthropological Work in Peru in 1913' (1914).

HROSWITHA. See Roswitha.

HSUAN TUNG, shoo'än' toong', reigning title of Pu-Yi, last of the Manchu dynasty of Chinese kings: b. 11 Feb. 1906. He was the son of Prince Chun, and nephew of the Emperor Kwang-su, whom he succeeded to the throne (1908). Prince Chun was appointed regent by the Empress Dowager Tzu-hsi. But her death a few hours after that of the emperor removed his most conservative opponent. Chun did all in his power to make the régime a liberal one, but was finally compelled to addicate to the republican forces in 1912. The emperor was retired, thus bringing the Manchu dynasty to a close. He was given a residence and a yearly income of 4,000,000 taels. A reactionary movement against the Chinese republic was launched in July 1917, which was successful in restoring Hsuan Tung. A few days later he was forced again to abdicate.

HUAINA CAPAC, wä-ē'nä kä'päk, or **HUAYNA CAPAC**, 11th Peruvian Inca: b. Cuzco, Peru, about 1450; d. Tumibamba, Ecuador, November 1525. He began his reign in 1480, or, according to some authorities, 1491, and made many conquests, even subduing the country as far south as Chile. Bv his will he divided the empire between two of his sons, Huascar and Atahualpa (q.v.). Consult Markham, 'The Incas of Peru' (1910).

HUAMANGA, wä-män'gä, or **GUAMANGA**, gwä-män'gä, Peru, the former name of Ayacucho (q.v.).

HUAMBISA, wäm-bē'sạ, a tribe of South American Indians, of the Jivaroan linguistic stock, living on the upper Santiago and Marañon rivers, Peru. They are of savage habits, fair of skin and wear beards. In the 16th century they participated in the capture of the Spanish settlement at Sevilla del Oro, when several thousand Spanish women were carried off. Their coloring is accounted for by this admixture. In 1843, they wiped out the inhabitants of Santa Teresa, a town between the Santiago and Marona. They maintain a lofty isolation both from their Indian and white neighbors.

HUANACO, hwä-nä'kō, the most numerous and widely distributed of the two species of the genus *Lama* (*L. guanaco*), of the camel family, resident in South America. It is somewhat like a large goat in form, but with a much longer neck, surmounted by a small camel-like head and long, pointed, alert ears, but no weapons. A large male is about four feet tall at the withers, a female somewhat less. The coat is of long, woolly, reddish-gray hair, the improvement of which by selective breeding in domestication has formed the alpaca breed (see Alpaca). It roams the open plains of Argentina and Patagonia, serving as the principal game animal of that region, and furnishing the scattered natives with food, clothing and shelter. In the autumn it gathers into large herds and behaves in general like the antelopes of the similar arid plains of other parts of the world. Consult Darwin, Hudson, Spears and other writers on Patagonia. See Llama.

HUANACO, a department of Peru, having an area of over 14,000 square miles and 160,000 population. Also its capital, 175 miles northeast of Lima, a bishop's see, and a centre of a country rich in haciendas, and growing coffee, cotton and sugar.

HUANCAVELICA, wän'kạ-vä-lē'kạ, Peru (1) a department in the central part, bounded south by Ica, west by Lima, east by Ayacucho and north by Lima and Junin. It is traversed by the Cordillera Occidental, so that there is little agriculture possible. The principal industries are mining of silver and quicksilver. The area is 9,251 square miles. Pop. about 250,000. (2) A city and capital of the department of the same name. It is situated in a ravine of the Andes, at an elevation of 12,500 feet. It was founded in 1572 by Francisco de Toledo. The principal industry is mining. Pop. about 6,500.

HUANCAYO, wän-kä'yō, Peru, a town in the department of Junín, on the river Mantaro, situated at an elevation of about 11,000 feet. Pop. about 5,000.

HUANG-HSING, or **HWANG-HSING,** kwäng'shing', Chinese general and revolutionist: b. near Changsha, Hunan Province, 1875. After studying at native colleges, he was graduated at Tokio University, Japan. His active propaganda against the Manchu dynasty brought upon him the odium of the government and he was forced to flee. He took refuge in Japan where he carried on his efforts in behalf of the revolution. With the funds which had been collected by Dr. Sun Yat-sen, he gathered forces and was second in command in the attacks against the imperial forces at Hankow, Hanyang and Wuchang. Under Dr. Sun's provisional administration Huang-Hsing was made Premier and Minister of Navy and Marine. In 1912 when Yuan Shihkai was elected President, the provisional Premier was appointed commander-in-chief of the Southern army. In this capacity he was instrumental in founding the Southern party or Kuomintang, which incurred the displeasure of President Yuan and resulted in the expulsion of Huang-Hsing from the Peking Assembly. He led an unsuccessful revolt in protest and was forced to retire. He visited the United States in 1914.

HUÁNUCO, wä'nū-kō, Peru, city and capital of the department of the same name. It is situated at an elevation of some 6,000 feet, not far from the Hualaga River, about 170 miles northeast of Lima. Founded by Gomez Alvarado in 1539, Huánuco, in the years 1881 to 1883, was almost destroyed by the Chilean riots and massacres. It is the seat of a bishopric and until 1855 was the capital of the department of Junín. The chief industries are the manufacture of cocaine and mining. It is also renowned for its wonderful fruits and sweetmeats. The Inca town of Huánuco Viejo, which was settled by Spaniards in 1535 and is practically abandoned now, is not far distant. Pop. about 7,500.

HUÁNUCO, a department of Peru, bounded by Loreto on the north and east, Junín on the south and Ancachs on the west. The Cordillera traverse the department, rising to a great height in the western part. The principal rivers are the Marañon and Huallaga, and there are numerous smaller streams, including the headwaters of the Amazon. The chief industries are mining of gold, silver and quicksilver and the cultivation of coffee, tobacco and sugar-cane. Area 14,024 square miles. Pop. about 150,000.

HUARAZ, or **HUARAS,** wä'ras, a city of Peru, capital of the department of Ancachs on the river of the same name, about 60 miles from the coast, with which it is connected by rail, and 190 miles northwest of Lima. It is situated at a considerable elevation, in a fertile valley of the Cordillera Occidental. The climate is mild and the appearance of the town severely plain. The principal buildings are the government quarters, the hospital, school and churches. The chief industries are agriculture, principally wheat-raising, sugar and fruit, cattle-farming and the mining of copper, coal, gold and silver. There are interesting ruins in the vicinity of the aboriginal Incas.

HUARTE DE SAN JUAN, wär'tä dä sän hwän, or **HUARTE Y NAVARRO, Juan de Dios,** Spanish physician and psychologist: b. Lower Navarre, about 1530; d. about 1592. He received his medical education at the University of Huesca and rendered important service in the plague at Baeza (1566). He is known principally for his unique book on phrenology, 'Exámen de ingenios para las ciencias' (1575), which was translated into several European tongues. It is interesting as the first attempt to establish the relation between psychology and physiology and to present new and bold theories of education. Consult Guardia, J. M., 'Ensayo sobre la obra de J. Huarte' (Paris 1855); and 'Biblioteca de autores españoles' (Vol. LXV, Madrid 1873).

HUASCAR, wäs'kär, Peruvian Inca, son of Huaina Capac (q.v.). See Atahualpa.

HUASCO, wäs'kō, Chile, a port in the province of Atacama. Several steamship lines connect with the port and are served by railways from the interior. The important exports are copper, silver, gold, hay, produce and cattle. Pop. about 2,500.

HUASTECS, wäs'tĕks, a tribe of Indians of the Mayan stock, living in the state of Vera Cruz and San Luis. From the archaic forms of their language, as well as from their legends, it is inferred that this tribe was left behind in a southward migration of the Mayan tribes of Central America.

HUAYNA CAPAC. See Huaina Capac.

HUBAY, hoo'bō-ĭ, **Jenö,** Hungarian violinist: b. Budapest 1858. His master was Joachim at Berlin. He made his début in Hungary at the age of 18, and later went to Paris where he met with splendid success. In 1882 he was head violinist at the Conservatory at Brussels, and four years later succeeded his father, Charles Hubay, as chief professor at the Budapest Conservatory. His compositions include several operas: 'Der Geigenmacher von Cremona' (1893); 'Alienor' (1892); 'A falu rózsa,' Hungarian opera; 'Lavothas Liebe' (1906), and 'Anna Karenina' (1915); a symphony, a concerto for the violin and numerous single pieces for the violin.

HUBBARD, Elbert, American author: b. Bloomington, Ill., 19 June 1859; d. on the *Lusitania*, 7 May 1915. After working on a farm as a boy, he went to Chicago, where he entered a printing-office and later was employed in a soap factory. In the latter business he rose to be manager and finally partner of the firm; selling out his interest, he devoted himself for a time to study and travel and finally settled at East Aurora, where he established the Roycroft shop, devoted mainly to the artistic printing and binding of books. Hubbard edited the *Philistine*, a "magazine of protest," and wrote 'Little Journeys' (biographical sketches); 'No Enemy but Himself'; 'Message to Garcia' (1898); 'Time and Chance' (1901); 'The Man of Sorrows' (1904); 'Hollyhocks and Golden Glow' (1912).

HUBBARD, Joseph Stillman, American astronomer: b. New Haven, Conn., 7 Sept. 1823; d. there, 16 Aug. 1863. He was graduated from Yale in 1843 and in 1844 accepted a call to Washington from Lieutenant Frémont for the purpose of computing the observations for latitude and longitude made during the latter's transcontinental journey. From 1845 until his death he was stationed at the Washington Observatory as professor of mathematics in the United States navy. He made important investigations regarding comets, was at two different periods editor of the *Astronomical Journal*, and was a member of the National Academy of Sciences, of the National Institute of Washington, of the Connecticut and of the American Academies of Arts and Sciences, and of the American Philosophical Society. The results of his astronomical observations have been published in successive numbers of the *Astronomical Journal*. Consult Gould, B. A., ‘Memoir of J. S. Hubbard’ (in ‘National Academy of Sciences, Biographical Memoirs,’ Vol. I, Washington 1877).

HUBBARD, Leonidas, Jr., American journalist, writer and explorer: b. Waldron, Mich., 12 July 1872; d. Labrador, 18 Oct. 1903. He was a teacher in the public school at Angola, Ind., while still in his teens and early in life showed keen interest in writing, exploration and athletics. He was graduated from University of Michigan in 1897. While still at college he did reportorial work in Ann Arbor and later on the Detroit *Evening News*. He came to New York in the summer of 1899 and attached himself to the staff of the *Daily News*, but early in 1902 became associate editor of *Outing*, in which work he was much interested. He conceived the idea of exploring into the wilds of Labrador and 20 June 1903, accompanied by Dillon Wallace, a New York lawyer, and George Elson, a Cree Indian guide, he left New York, going by steamer from Saint Johns, N. B., to Rigolette, a Hudson Bay trading post on the Grand River. From this point Hubbard and his friends traveled by canoe and on foot, mapping correctly for the first time Grand Lake; then penetrating the interior in a westerly and northwesterly direction, mapping the course of the Beaver River from its source to the point where it flows into the southeast bay of Lake Michikamau; and locating and mapping several large lakes in the interior. The party penetrated some 250 miles further into new territory than any previous expedition. Notes on the geology and general observation of the topography of the country were also made. The small party struck unexpected difficulties and an unusual scarcity of game, which combined to hold them back until winter had overtaken them. Hubbard's health gradually weakened and when he had become too weak to continue he insisted that his two companions should keep on without him. By the time help was brought to him he was dead. Wallace, who broke down a few days later, was rescued and brought his friend's body to New York. His wife, Mina Benson Hubbard, undertook in 1905 to complete her late husband's plans and made a successful journey into the interior of Labrador. Among Mr. Hubbard's most noted writings are ‘The Moonshiner at Home’ (1902); ‘Barataria’ (1902); ‘Going to the Woods’ (1903); ‘Children of the Bush’ (1903); and ‘Where Romance Lingers’ (1904). He also wrote many short articles on outdoor life which were published in *Outing* from 1900 to 1904. Consult Ellis, M. B. Hubbard, ‘A Woman's Way Through Unknown Labrador, etc.’ (New York 1908); Wallace, D., ‘The Lure of the Labrador Wild’ (New York 1905); id., ‘Leonidas Hubbard’ (in *Outing*, Vol. LIX, p. 189, New York 1911); Whitney, C., ‘Hubbard Expeditions into Labrador’ (in *Outing*, Vol. XLV, p. 643, New York 1905).

HUBBARD, Richard William, American artist: b. Middletown, Conn., 15 Oct. 1810; d. 1888. He was educated at Yale, set up his studio in New York and was elected to the National Academy in 1858. Among his numerous American landscapes are ‘Mansfield Mountain at Sunset’; ‘Showery Day, Lake George’; ‘Glimpse of the Adirondacks’; and ‘Lake Cazenovia.’

HUBBARD, William, American colonial clergyman and historian: b. Tendring, Essex, England, 1621; d. Ipswich, Mass., 14 Sept. 1704. He came to New England in the *Defence* in 1635, settled with his father at Ipswich, was graduated at Harvard College in 1642, and was ordained about 1656 as minister at Ipswich, where he continued during the remainder of his life. He is the author of ‘The Present State of New England, Being a Narrative of the Troubles with the Indians from 1607 to 1677, etc.,’ the map accompanying which is supposed to be the first executed in America. It was first published in 1677, both in Boston and London, and has gone through some 10 further editions, the latest and most carefully annotated of which was edited by S. G. Drake (2 vols., Roxbury 1865). He left in manuscript a ‘General History of New England,’ for which the colony paid him £50, and which has been consulted with advantage by Mather, Hutchinson, Holmes and other American historians and annalists. However, it should be used with considerable discretion as it is far from being absolutely correct. It was published by the Massachusetts Historical Society in 1815 and republished in 1848. Consult Caldwell, A., ‘William Hubbard and His Parish’ (Boston 1885); Deane, C., ‘Hubbard's Map of New England’ (in *Massachusetts Historical Society Proceedings*, Vol. IV, p. 13, Boston 1887); Green, S. A., ‘Hubbard's Map of New England’ (ib., Vol. IV, p. 199; Vol. VI, p. 41, Boston 1888 and 1890).

HUBBARDTON, Vt., town in Rutland County, 13 miles from Castleton, its nearest railroad station. It is in an agricultural region, and has but little manufacturing; its raw products are sent direct to the markets. On 7 July 1777 a battle took place here between the Americans under Colonels Francis and Warner, and a British and Hessian force under Generals Riedesel and Fraser, in which the British were successful. The Americans, the rear-guard of General St. Clair's army, who were retreating from Ticonderoga, lost in killed, wounded and prisoner's 324 men; and the British loss was 183 men. A monument in memory of the American soldiers who were killed in this battle occupies a prominent position. Pop. 500.

HUBER, hoo'bėr, **Eugen**, Swiss lawyer: b. Stammheim, Canton Zürich, 1849. After several years of private practise, he became lecturer at the University of Bern (1873); and later (1880) professor of civil law at Basel; at Halle (1888); and in 1902 returned to Bern as professor. He took an active part in the political life of his nation, as a member of the Swiss National Council and as a life member of the Permanent Court of Arbitration at The Hague. His principal contribution to the law of Switzerland has been his codification of the civil law and the standardization of court usage. Since 1907, he has been editor of *Schweizerisches Zivilgesetzbuch*. The most widely known of his legal publications is 'System und Geschichte des schweizerischen Privatsrechts' (4 vols., 1886–93).

HUBER, u'bãr', **François**, Swiss naturalist: b. Geneva, 1750; d. Lausanne, 1831. His father was a naturalist of some repute and his mother a well-known writer on religious subjects and translator of the *Spectator*. As a boy François received careful training in the sciences; but before he was 15, his eyes began to weaken and he eventually became blind. However, his interest in nature was greatly stimulated by his wife, Marie Aimée Lullin; and with her aid, assisted also by his devoted servant, François Burnens, his research was made possible. His principal investigations were in the life-cycle of the bee, in which study he was the first scientist of distinction. His observations were published as 'Nouvelles Observations sur les abeilles' (Geneva 1792). With Jean Senebier he published also 'Mémoires sur l'influence de l'air, etc., dans la germination' (1800); and 'Mémoires sur l'origine de la cire.' His son, PIERRE, carried on the work of his father and published numerous short papers on entomological subjects, of which the best known is 'Recherches sur les mœurs des fourmis indigènes' (Geneva and Paris 1810, 1861).

HUBER, Johannes, German philosopher and theologian: b. Munich, 18 Aug. 1830; d. there, 19 March 1879. He was educated at the University of Munich, became professor of philosophy there in 1859, and was one of the leaders of the Old Catholic party and an active opponent of the Ultramontanes. He vigorously attacked the definition of the dogma of papal infallibility. Among his works were 'Studies' (1867); 'Das Papsttum und der Staat' (1870); 'Der Jesuitenorden' (1873); and 'Zur Philosophie der Astronomie' (1877). Consult Zirngiebl, E., 'Johannes Huber' (Gotha 1881).

HUBER, Ludwig, Ferdinand, German author: b. Paris, 14 Sept. 1764; d. Swabia, 24 Dec. 1804. In 1766 he was brought to Leipzig and subsequently received his training in languages and literature in that city. His literary talent soon impressed itself on his contemporaries, and he was admitted to the talented group of writers of the period which included Körner and Schiller. From 1787–92, he was secretary of the Saxon legation at Mainz, where he fell in love with Therese Forster. On the death of Forster, he married the clever Therese. Four years later he assumed the editorship of the *Allgemeine Zeitung;* and was appointed counsellor of education for Swabia (1804) a few months before his death. In addition to his political writings which were contributed largely to *Friedens-präliminarien* and *Klio*, he was the author of numerous plays, of which the one which has endured is 'Das heimliche Gericht.' As a critic he was highly esteemed, his best essays appearing as 'Vermischte Schriften von dem Verfosser des heimlichen Gerichts' (1793). A collection of his works was published posthumously with a biography by his wife (4 vols., 1807–19).

HUBER, Victor Aimé, German publicist and author: b. Stuttgart, 10 March 1800; d. Wernigerode, 19 July 1869. Educated at Würzburg and Göttingen, he became professor of the history of literature and of modern history at Rostock in 1833, of the languages of western Europe at Marburg in 1836, and at Berlin in 1843. He retired in 1850. Huber was one of the most profound of German scholars in the Spanish language and literature. Among his publications were 'Die Geschichte des Cid' (1829); 'Die englischen universitäten' (1839–40); 'Crónica del Cid' (1844); and 'Skizzen aus Spanien' (1825–35).

HUBERT, Saint, apostle of Ardemes, the patron of huntsmen; d. about 727. Legend says that he was a keen hunter, and that being once engaged in the chase on Good Friday, in the forest of Ardennes, a stag appeared to him having a shining crucifix between its antlers, and he heard a warning voice. He was converted, entered the church and became bishop of Maestricht and Liège. He worked many miracles, and his body, at first deposited in the church of Saint Peter at Liège, was in 817 conveyed to the Benedictine convent of Andain, in the Ardennes, which received the name Saint Hubert's of Ardennes. The day of the saint is 3 November, and was formerly celebrated at many courts by a solemn chase.

HUBERT DE BURGH, English statesman: d. London, 12 May 1243. He held office under Richard Cœur de Lion, and was made castellan of Falaise by King John, with whom he sided in the struggle with the barons, though advising the granting of Magna Charta. In the year of Runnymede (1215) he was made justiciar (chief justice) of England. On 24 Aug. 1217 he won a great victory over a French fleet bringing reinforcements to the army besieging Dover Castle; the Treaty of Lambeth was concluded (11 September) and the enemy evacuated England. After 1219 he was coregent with Langton, archbishop of Canterbury, for Henry III. He vigorously opposed the foreigners who were endeavoring to obtain control of the government, and sought to end the exactions of the clergy. In 1232 he was dismissed, owing largely to his failures in the conflict with the Welsh, and thereafter he had no part in the government.

HUBERTUSBURG, hoo-bėr'tŭs-bûrk, Saxony, a château and royal hunting seat, near Wermsdorf, between Oschatz and Grimma. It is known principally as the scene of the signing of the peace which brought the Seven Years' War to a conclusion. It serves at present as an asylum for the insane. Consult Riemer, 'Das Schloss Hubertusburg, sonst und jetzt' (Oschatz 1881).

HUBLI, hoo'blĭ, British India, a town in the Dharwar district of Bombay, 15 miles southeast of the town of Dharwar, and 90 miles northeast of Karwar. The principal trade is in cotton, grain, salt and produce. There is also considerable manufacture of cotton. Several ancient temples belonging to the Jains are here. An English factory was established early in the

17th century, but was plundered by Sivaji, a Mahratta chief, in 1673.

HÜBNER, hup'nėr, **Emil**, German classicist: b. Düsseldorf, 1834; d. Berlin, 1901. After studying at Berlin and Bonn, he traveled widely on the Continent. On his return to Germany, he became professor at the University of Berlin, where he remained from 1870 until his death. His work consists mainly in researches in Latin epigraphy. His numerous publications in this field include 'De Senatus Populique Romani Actis' (1859); 'Epigraphische Reiseberichte aus Spanien und Portugal' (1861); 'Die Antiken Bildwerke in Madrid' (1862); 'Inscriptiones Hispaniæ Latinæ' (1869, 1892); 'Inscriptiones Hispaniæ Christinæ' (1871, 1900); Exempla Scripturæ Epigraphicæ Latinæ' (1885); 'Monumenta Linguæ Ibericæ' (1893); 'Über mechanische Copien von inschriften' (1881); 'Grundniss zu Vorlesungen über die römische Litteraturgeschichte' (4th ed., 1878); 'Bibliographie der klassischen Altertumswissenschaft' (1889); 'Römische Herrschaft in Westeuropa' (1890); 'Römische Epigraphik' (1892). He was coeditor of *Hermes* (1866–81), and the *Archäologische Zeitung* (1868–73).

HÜBNER, Joseph Alexander, COUNT, Austrian diplomat: b. Vienna, 26 Nov. 1811; d. there, 30 July 1892. He was educated at Vienna, and, having entered the service of the government, became in 1849 Minister at Paris, and in 1865–68 was Ambassador at Rome. In 1879 he became a member of the Clerical-Conservative wing in the upper house of the Reichsrat. Among his published works are 'Sixte-Quint-D'après des Correspondances Diplomatiques Inédites' (1870, new ed., 1883); 'Ein Spaziergang um die Welt' (1872, 7th ed., 1891); and 'Durch das Britische Reich' (1886; 2d ed., 1891).

HÜBNER, Julius, German painter and poet: b. Oels, Silesia, 27 Jan. 1806; d. Losehwitz, Saxony, 7 Nov. 1882. He studied at the Berlin Academy, and was also a pupil of Schadow at Berlin and Düsseldorf. In 1841 he became professor in the Dresden Academy of Arts. He was an historical painter of the Düsseldorf School, his works including 'Disputation between Luther and Eck'; 'Charles V and Saint Just,' and 'Last Days of Frederick the Great.'

HUBNERITE. A mineral consisting of manganese tungstate, $MnWo_4$, containing 76.6 per cent of tungsten trioxide when pure. A source of tungsten, ferrotungsten and sodium tungstate. Mined in places near Diagoon and from quartz veins in granite at Arivaca, Ariz. In Colorado occurs in gold ore at Leadville, and mined in Uncompahgre district and near Silverton and Gladstone. In Idaho mined in Bluewater district. Small quantities occur at several places in Montana. Mined at Ellsworth, Round Mountain, Hub and other places in Nevada and in Victoria district, New Mexico.

HUC, ük, **Évariste Régis,** French Roman Catholic missionary: b. Toulouse, 1 Aug. 1813; d. Paris, 31 March 1860. After studying at Toulouse, he joined the Congregation of Saint Lazarus at Paris and was sent to China in 1839. He was occupied for a time in the southern province, and then set out for the north and succeeded in establishing a settlement not far from Peking. In 1844, he undertook a journey through Tibet, and had penetrated as far as Thasa (1846) when he, with his companion, Gabet, were returned to China by orders of the Chinese Ambassador. He visited India, Egypt and Palestine, and returned to Europe in 1852. His accounts of his voyages are contained in 'Souvenirs d'un voyage dans la Tartarie, le Thibet et la Chine' (2 vols., Paris 1850, Eng. trans., London 1851); 'L'Empire Chinois' (2 vols., Paris 1854, Eng., trans., London 1855); 'Le Christianisme en Chine, en Tartarie, et au Thibet' (4 vols., Paris 1857–58, Eng. trans., 3 vols., London 1857–58). The historical information contained in these works is still valuable, although it was received by his contemporaries in Europe with incredulity. Consult Henri d'Orléans, 'Le père Huc et ses critiques' (Paris 1893).

HUCBALD, or HUBALD, Benedictine monk and musician: b. Saint-Amand, near Tournai, about 840; d. there, about 930. Most of his life was spent in the monastery of Saint-Amand, where his uncle Milo conducted a school. He was absent for a number of years, but returned to Saint-Amand in 872, when he succeeded his uncle in his position at the school. Hucbald is noted principally as a composer of music and of treatises on music. There are numerous works which have been ascribed to him, but the most authentic of these is 'Harmonica Institutio,' a system of musical education. 'The Musica Enchiriadis,' long attributed to Hucbald, has been proven to have been of a later period. Consult Müller, 'Hucbald's echte und unechte Schriften über Musik' (Leipzig 1884).

HUCH, hoog', **Ricarda,** German novelist: b. Braunschweig, 18 July 1864. She lost her parents early and was educated by her grandmother, to whom she dedicated her drama 'Evoe' (1892). This is an historical Renaissance drama and has been called an overture to her later works. Being desirous of obtaining a higher education, she entered the University of Zürich, one of the first higher institutions of learning in Europe, admitting women on a par with men. She took the degree Ph.D. in 1891 and then accepted a position as secretary at the city library in Zürich. Later she traveled, especially in Italy, and returned to Germany in 1897. After marrying an Italian dentist, Ceconi, she lived for a time in Vienna and Munich. She has since been divorced from her husband, has married her cousin, Richard Huch, a lawyer, and now resides with him in Braunschweig. Her writings are of three types, poems, novels and stories, and literary criticism. Her poems were published in two collections: 'Sammlung von Gedichten' (1894) and 'Neue Gedichte' (1907). At first she worked under the influence of Conrad Ferdinand Meyer. She loves to comment on life in her poetry and therefore her poems are not always purely lyrical, but they are full of reverence for things beautiful. She does not wish to reproduce everyday life, but to suggest that which is noble, artistic and musical. She has a keen sense for the beautiful in color, tone and similes. Her chief novel is 'Ludolf Ursleu' (1893). It is the history of the decline of a patrician family of the city of Hamburg. 'Vita Somnium Breve' (1902) is a variation of the same theme.

A third novel, ‘Aus der Triumphgasse’ (1901), takes us to the slum district of an Italian city. She contrasts the aristocratic-æsthetic view of life of the Romanticists with the social-democratic views of our days. Her writings on literary criticism comprise ‘Die Blütezeit der Romantik’ (1899); ‘Ausbreitung und Verfall der Romantik’ (1902), and an essay on Gottfried Keller. They are distinguished by sympathetic interpretation and psychological insight. Recently she has added to this list a book entitled ‘Natur und Geist als Würzeln des Lebens und der Kunst’ (1915). Her other literary writings are ‘Der Bundesschwur’ (1891); the modern fairy tale ‘Mondreigen von Schlaraffis’ (1896); ‘Die Teufeleien’ (1897), humorous stories; and ‘Haduvig im Kreuzgang,’ (1897), a realistic story of dreams and visions’; the novel ‘Liebe’ (1899); and the stories ‘Fra Celeste’ (1900); ‘Von den Königen und der Krone’ (1904); and ‘Seifenblasen’ (1905). Her writings of an historical nature are ‘Das Risorgimento’ (1908); ‘Das Leben des Grafen Federigo Confalonieri’ (1910); ‘Die Geschichte von Garibaldi’ (1906–07); and ‘Der Grosse Krieg in Deutschland’ (1913), treating of the Thirty Years’ War. In these writings she has undertaken to use the novelist’s and storyteller’s art in delineating important epochs in the world’s history and to present with poetical freedom characters which are true to that history. Consult Elfriede Gottlieb, ‘Ricarda Huch’ (Leipzig 1914); Friedrich Schoenemann, Vol. XVIII of ‘The German Classics’ (New York 1914).

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HUCKLEBERRY, a name of uncertain derivation applied to a variety of shrubs, especially to species of the genus *Gaylussacia,* and also to those belonging to the genus *Vaccinium.* The principal species are found mainly in the northern hemisphere, throughout North America and Europe. In many places in the United States huckleberries are a valuable product, the fields in which they grow are preserved and the berries are secured either for household use or for profitable marketing.

HUCKLEBERRY FINN, The Adventures of, a story by Samuel L. Clemens («Mark Twain»), (q.v.), published almost simultaneously in London and New York in 1884, parts of it having been previously published in the *Century Magazine.* It was the first book brought out by the firm of C. L. Webster and Company of which its author was a member. Even previous to its actual publication 40,000 copies had been sold to subscribers. It was illustrated according to the author’s own ideas by E. W. Kemble and has gone through many editions. It is a sequel to, and follows the fortunes of, the leading characters of the same author’s ‘Tom Sawyer.’ In this book the author not only preserves to us a valuable record of a rapidly disappearing social order, but throws light upon some questions of moment to the student of history. It is, perhaps, Mark Twain’s most notable work of pure fiction and was received with great enthusiasm by many keen critics. At one time it created considerable discussion by the action of a number of librarians who removed it from the shelves of their institutions on account of some imaginary shortcomings in «Huck’s» moral character. Consult Henderson, A., ‘Mark Twain’ (New York 1911); Johnson, M., ‘A bibliography of the Work of Mark Twain, etc.’ (New York 1910); Paine, A. B., ‘Mark Twain’ (3 vols., New York 1912).

HUCKNALL TORKARD, England, a town in Nottinghamshire, five miles north of Nottingham, and 132 miles northwest of London, on the Great Central, Great Northern and Midland railways. Near by is Newstead Abbey where Byron lived; and his tomb is in the old town parish church of Saint Mary Magdalene. The principal industries are the manufacture of tobacco and hosiery, and coal mining. Pop. about 16,000.

HUDDE, hud′de, **Andreas,** Dutch merchant: b. about 1600; d. 1663. He was a prominent member of the Dutch West India Company and in 1633 was director-general in America. The company awarded him important posts in its newly found territory. He was surveyor of Manhattan (1642); and arbitrator in the disputes between the Dutch and Swedish settlers on the Delaware River, which territory he finally conquered and held for the company. His prestige continued and grew. He was placed in command of Forts Altona and New Göttenburg (1657); was colonial surveyor, and later parish clerk. His records in the Albany archives testify to the quality of his intellect and his education.

HUDDERSFIELD, England, municipal, county and parliamentary borough in the West Riding of Yorkshire, on the Colne, 16 miles southwest of Leeds. It is the chief seat of the English cloth and woolen manufacture and also manufactures silk, iron and machinery. Coal-mining and stone-quarrying are also carried on extensively. The borough has good water power and many of the industries are run by it. The town is thoroughly modern, is well built and has spacious streets. It has also fine churches and public buildings. There are here a proprietary college affiliated with the University of London, a technical school and several grammar schools. The municipal government is of a high order and has been a pioneer in several important particulars. The town was the first to own and operate its street railways; it owns its gas, electric and water plants, maintains free public libraries, a slaughter-house, public markets, a hospital, cemeteries and a modern sewage disposal plant. It was the first town to adopt an eight-hour labor day. As far back as 1853 artisan’s dwellings were established for married couples and for single women as well as for bachelors. In ancient times known as Odersfelt, Huddersfield has been of importance only from the establishment of the woolen industry in the 18th century. A consulate of the United States is located here. Pop. 107,821.

HUDIBRAS. This satirical mock-epic by Samuel Butler, perhaps the wittiest poem ever written in the English language, consists of 11,000 lines of so-called «Hudibrastic» verse (Iambic tetrameter, with burlesque rhymes), and is divided into three parts, each of several cantos. The action, which fills only about 1,800 lines, is constantly interrupted by digressions upon a variety of themes. It is often stated that Hudibras is a kind of rhymed parody of

'Don Quixote,' which is frequently alluded to and is even travestied in several of its minor incidents; but, except for the idea of a crazy knight and his squire setting out to reform the world, Butler owes little to Cervantes, and 'Hudibras' might have been substantially the same had 'Don Quixote' never have been written. The initial suggestion might have come as well from the 'Fairy Queen' or from the 'Morte D'Arthur.' It is probable that Butler named his poem and its protagonist after Spenser's Sir Huddibras ('Fairy Queen,' II, 2), a knight "more huge in strength than wise in works"; though it has been suggested that he derived the name from Hugh de Bras, the patron saint of Devonshire, where he lived for a time in the employ of Sir Henry Rosewell.

The story concerns Sir Hudibras, a religious-mad Presbyterian, and Ralpho, his squire, who set forth to reform social abuses banned by the Puritans. Their fight with the bear-baiters and their defeat; Hudibras in the stocks and his release by his Lady; his oath of flagellation — which he breaks; their rout by the merry-makers; their visit to the astrologer Sidrophel — whom they rob; plots and counter-plots by both Hudibras and Ralpho, each in turn in league with the Lady, are the main incidents of the disconnected story, which breaks off but does not end. The characterization is weak and inconsistent; the characters being in the main mere nicknames for absurdities. Hudibras, perhaps in part a caricature of Sir Samuel Luke, once an employer of Butler's, is a mixture of incongruous traits, knight errant plus Presbyterian magistrate, who, although meant to be ridiculous and cowardly, at times talks good sense and fights right valiantly. Minor characters have been identified with various members of the Puritan party, but such identification is uncertain and unimportant. The character of Sidrophel the astrologer is certainly meant for William Lilly, a notorious impostor of the day. This portrait of the universal and permanent quack is Butler's masterpiece; but the portraits of Shaftsbury and Lilburn are also admirable, and perhaps furnished Dryden with models for his 'Absolom and Achitophel.'

The story itself, with its satire on Puritanism, serves merely as a frame on which Butler hangs his ridicule of the many excesses of contemporary life. A conservative in politics and a rationalist in religion, he was a royalist and an Episcopalian not through sentiment or religious conviction but through hatred of excess and dislike of change. Of strong, well-balanced mind and of eminent good sense, he saw in royalty and in an established church the safety of the state. Satire makes no fine distinctions, and Butler's portrait of Puritanism is of course the grossest and most unfair caricature; but in his burlesque of Puritan habits of mind and speech there was enough truth to render his satire wonderfully telling. He touches upon religion in general apart from Puritanism; upon contemporary science (the researches of the Royal Society he especially ridicules); upon matrimony; upon astrology and kindred superstitions; upon lawyers, with incidental satire on a large variety of political, moral, social and literary themes. The enormous whole forms a "commonplace-book" of satire, for which Butler's prose notebooks furnished the material, gathered through an entire life of observation and reflection and in parts talked out many a time over a bottle with his friends. 'Hudibras' is utterly devoid of poetry or sentiment. This is amply compensated for by its brilliant and pervasive wit, which, though so often based upon the local, or the temporary, or the recondite as to be unintelligible without the aid of explanatory notes, occasionally attains the universal, and in such passages has become a part of the language. The style of the poem, compounded of its peculiarities of metre, diction and figures of speech, is so original and individual as simply to be termed "Hudibrastic." Butler employs the old iambic tetrameter but gives it a twist of his own by means of astonishing rhymes. He changes the vowel sounds, forces two monosyllabic words to rhyme with a dissyllable, and employs frequent trisyllabic rhymes that are always outrageous but often irresistibly comic. For all this he gained hints from his predecessors, such as Ben Jonson and John Taylor, the "water poet," but he was the first to popularize the practice. Working with the rhyme to make the burlesque effect is Butler's habit of levying upon all fields of knowledge for his illustrations, of alluding even to the most recondite, almost unheard-of things in history, science, pseudo-science, mediæval lore of all kinds. Rabelais and Burton in prose and Cleveland in verse satire had done something of this kind, but Butler is without a peer in the range of his material and in his extravagant use of it.

Although a portion of 'Hudibras' was written before the execution of Charles I, even the first part was not published until 1663; a second followed in 1664, and a third and last in 1678. Thus the satire as an attack upon Puritianism lost utterly any militant value. But few works have ever gained such immediate and universal popularity. It became household property among the royalist reading public, not through whatever of permanent truth it contained, but through its partisanship. No poem in English has ever bred so many imitations. Within the century after its publication appeared at least 23 Hudibrastic satires, many of great length and of intolerable dullness and, oftentimes, of obscenity. Its influence was rife even in America, and it is notable that the only one of these imitations which shows any originality is 'McFingal,' an able political satire by John Trumbull the American, some of whose couplets are often credited to Butler. That 'Hudibras' has practically ceased to be read is not altogether to the credit of the public. True, it is verbose; its political significance has passed; many of its allusions are unintelligible to the average reader; but, on the other hand, much of its satire will remain perennially applicable as long as society contains absurdities and shams, and much of its wit yet sparkles after the lapse of over two centuries.

There are many editions. That edited by Dr. Zachary Grey (Dublin 1744, rep. London 1869) is the standard; Hogarth's illustrations are in the London edition of 1726, reprinted 1775; Grey's notes are used in the three-volume London edition of 1819; the Bohn Library edition (London 1859) contains notes by Grey and Nash. Among other editions are the Aldine 'Poetical Works of Samuel Butler' (London 1893), and that by A. R. Waller

(Cambridge, England, 1905). 'Hudibras' was translated by John Townley into French verse (London 1757) and by D. W. Soltau into German (Riga 1787). Among critical studies are 'Butler's Hudibras, ein echte zeit- und sittengemälde,' Rudolph Boxberger (Leipzig 1876), and 'Die Reime von Butler's Hudibras; eine metrische und lautliche Untersuching,' Bruno Harder (Königsberg 1900).

MARION TUCKER.

HUDSON, Erasmus Darwin, American physician: b. Northampton, Mass., 1843; d. New York, 1887. In 1864 he was graduated at the College of the City of New York and three years later at the College of Physicians and Surgeons, New York. He entered Bellevue Hospital as surgeon immediately thereafter, and in 1869–70 was appointed health officer of New York city. Subsequently he was professor of principles and practise of medicine at the Woman's Medical College (1872–82), and from the last-named year until his death was professor of general medicine and diseases of the chest at the New York Polyclinic. His works include 'Report of Pulse and Respiration of Infants' (in Eliot's Obstetric Clinic, 1872); 'Doctors, Hygiene and Therapeutics' (1877); 'Methods of Examining Weak Chests' (1885); 'Limitations of the Diagnosis of Malaria' (1885); 'Home Treatment of Consumptives' (1886); 'Physical Diagnosis of Thoracic Diseases' (1887).

HUDSON, George, English railway speculator: b. York, March 1800; d. London, 14 Dec. 1871. He began as a linendraper's apprentice, and soon acquired a considerable fortune in that business. At the age of 27, he fell heir to £30,000. He immediately began to invest in railroads, especially in the North Midland line, and his energy and zeal soon elevated him to the position of director. In 1833 he organized the York Banking Company, and in 1837 became mayor of York. The projection of new railroads now occupied his attention, until, by 1844, he was the owner of more than 1,000 miles of railway and was known as the "railway king." His fortune accumulated rapidly and honors were heaped upon him. Re-election to the mayoralty came twice; and finally, in 1845, he was sent to Parliament. Two years later the crash came; railway property experienced a sudden decline, and Hudson was involved in overwhelming difficulties. Investigations revealed the fact that the money invested had been unscrupulously handled; Hudson spent his last years on the Continent, living on an annuity supplied by his friends.

HUDSON, Henry, English navigator. (Some authorities gave his name as Hendrick). The time and place of his birth appear to be lost. We only know that he had earned, perhaps by the time he was 40, sufficient reputation as a bold and skilful navigator to be placed in command of the ship *Half Moon* of Amsterdam. Early in 1609 he made a contract with a party of Dutch merchants to act as captain of their private exploring expedition, and in the written agreement between them he was described as "Henry Hudson, Englishman." This settles the honor of his birth country, though nothing more. At that time the one great commercial demand was for a shorter and better, all-sea trade route to the Far East. It was known that there was land to the west of Europe and it was believed that a passage could be found through these lands directly westward to the East. It is clear that Hudson believed that the western route was the most promising and, no doubt, he suggested it to his employers, but they evidently had more faith in a sea passage north and then east, round Europe and Asia to China. Thus it happened this English sea captain sailed from the Dutch port of Amsterdam in the small ship *Half Moon* bound for China by the way of the North Cape. The ship's company of Dutch and English was fortunate in having as mate one Robert Juet (perhaps also of England), and the mate could read and write. Juet kept the ship's log, and in this log book on the first page are these words: "On Saturday, the five and twentieth of March, 1609, after the old account (style), we set sayl from Amsterdam, and by the seven and twentieth day we were down at the Texel; and by twelve of the clock we were off the land, it being east of us two leages off."

Once "off the land" the ship was free to go where the captain pleased and it certainly did not please the crew to face the arctic cold of the attempted voyage round Europe. Solid pack ice and the open mutiny of the crew decided Hudson to turn back and he steered south — and west. It is evident that he felt free to carry out his own plans and reach China by another route. His owners' plans had failed and, while his plan might fail, his success would justify his action. Hudson's decision was almost as bold as that of Columbus for, while he had, no doubt, some knowledge of the lands to the west, he evidently had no conception of the shape or size of North America nor of the width of the Pacific.

The *Half Moon* was a slow sailor, and four months passed before she made the land along the eastern coast of what is now the United States. The log book described the land as "low white sandy ground" — exactly describing all the shore line south of Sandy Hook. The book might also have described parts of Long Island or Cape Cod and it is clear it did not describe the coast of Maine, and it is more than probable the first land mentioned in the book was south of Sandy Hook for, on reaching the land and finding no passage westward, Hudson steered "northeast by north" until, about two weeks later, he came to a great bay. The log book which does not give the name of the month, and which must have been September, says, "And from that lake or bay the land lyeth north by east, and we had a great streame out of the bay." The *Half Moon* had found the "great stream" described by Verrazano, and with the flood tide sailed into New York Bay and headed for the Narrows and, as the log book says, "came to three great rivers." And it continues: "So we stood along to the northmost, thinking to have gone into it." The *Half Moon* was off Manhattan. It was true Verrazano, in 1524, had entered New York Bay and left a record of a high hill and a great bay out of which flowed a large river, but Verrazano had not the courage to pass the Narrows, except in a small boat. Other explorers may have looked into the bay. The *Half Moon* was the first ship to pass up the "great stream" and to Hudson belonged the entire honor of discovering and exploring the river that now bears his name.

The pages of Juet's journal tell nothing of Hudson's own hopes, fears and anticipations. Yet, it is fair to conclude that Juet's enthusiasm over the beauty and value of the great valley was shared by his captain and that the ship's log was, in a sense, a reflex of Hudson's own views. There is no hint of Hudson's belief that he could reach China by this route, yet it is reasonable to suppose he entered New York Bay in the hope that the «great stream» would lead through the land to the Pacific. The great size of the bay and river, and the fact that the tide flowed far into the land, and that for the first few days' sail the water remained salt, no doubt encouraged him to keep on through this most promising opening in the land. Favored by «fairer weather» and a favorable breeze he steered northerly over the wide salt arm of the sea until the apparent strait became a river and the sea water became fresh. At the Highlands all hope of a road to China must have faded away. Still, he would sail on, push through the mountains and see what manner of country lay beyond.

The items of the log book plainly show that Hudson, after passing the Highlands, began to recognize the transcendent importance of his discovery. He had found a new land of surpassing beauty and fertility and everywhere clothed in splendid forests. Hudson clearly recognized the commercial value of his discovery, for the log book enumerates all the potential wealth of the river and valley in fish, game, lumber, fruits, vegetables, grains and peltry. It even mentions the fact that Hudson, while the ship was at anchor somewhere near the present city of Hudson, sent the ship's carpenter ashore to fashion a new forearm out of one of the primeval trees — the first bit of lumbering done by white men in the valley. Hudson seems to have decided, after reaching the upper river and sailing to a point opposite the Catskills, that the best way to mollify his owners on his return would be to report as fully as possible the potential wealth he had discovered and he sent a boat up the river to explore the country. The boat party appears to have been absent several days, for they rowed up stream about nine leagues or perhaps beyond Albany, where, as the log book says, the boat found «it bee at an end for shipping to goe in — with but seven foot water and unconstant soundings.» Meanwhile Hudson evidently traded with the Indians for peltry, no doubt regarding the furs as something that would demonstrate to his merchant owners the value of his discovery.

Three weeks after the *Half Moon* entered «the great streame» she again passed Sandy Hook and steered away for Amsterdam. There is no record of the return voyage, nor is there any record of Hudson's report to the merchants of Amsterdam, yet it is evident that his story and perhaps the exhibit of peltry created a tremendous sensation in the commercial cities of Holland. Hudson appears not to have cared much about this side of the affair. He seems to have considered his voyage a failure. He had tried to reach China and failed, and wished to sail again, but the merchants seem to have been wholly occupied in fitting out new ships under more commercial captains and would not listen to him. At last, after some delay, he did secure a second ship and set forth once more to find a sea path through America. He appears to have thought there might be a passage round by the north of America and he steered for Baffin's Bay. Once more he found a great passage leading westward into the land, once more a salt water strait seemed to promise success, but it only led to an inland sea. His miserable crew, ignorant, frightened at the arctic cold and gathering ice, rose in mutiny, and putting their great captain in an open boat, with his son, a boy of seven, and some invalid sailors, set them adrift in the vast waters of Hudson Bay and left them there to perish. Consult Read, 'Historical Inquiry Concerning Henry Hudson'; Janvier, 'Henry Hudson' (1909).

HUDSON, Henry Norman, American Shakespearean scholar and Episcopal clergyman: b. Cornwall, Vt., 28 Jan. 1814; d. Cambridge, Mass., 16 Jan. 1886. He served as chaplain in the Civil War, was professor of Shakespeare at Boston University and for a time editor of the *Churchman*. He published 'Lectures on Shakespeare' (1848); 'Campaign with General Butler' (1865); 'Shakespeare, his Life, Art, and Characters' (4th ed., 1883); 'Essays on Education' (1883). He edited the Harvard and the University edition of Shakespeare.

HUDSON, William Henry, English educator and critic: b. London, England, 2 May 1862. He was for five years private secretary to Herbert Spencer, and coming to America was assistant librarian of Cornell University, 1890–92. From 1892–1907 he was professor of English literature at Leland Stanford Jr. University; from 1902–03 professional lecturer at the University of Chicago, and later staff lecturer in literature to the extension board of London University. He published 'The Church and the Stage' (1886); 'An Introduction to the Philosophy of Herbert Spencer' (1894); 'Studies in Interpretation' (1896); 'Idle Hours in a Library' (1897); 'The Study of English Literature' (1898); 'The Sphinx and Other Poems' (1900); 'The Meaning and Value of Poetry' (1901); 'Life of Sir Walter Scott' (1901); 'Famous Missions of California' (1901); 'Rousseau and Naturalism in Life and Thought' (1903); numerous volumes on English poets and literature (1910–12); 'The Story of the Renaissance' (1912); 'The Man Napoleon' (1915).

HUDSON, W. H., English naturalist and author. His boyhood was largely spent in Argentina and at school in the British Isles. He published 'The Purple Land,' a romance (1885; new ed., 1916); 'Argentine Ornithology' (collaborating with Dr. P. L. Sclater, F. R. S., 1888–89); 'The Naturalist in La Plata' (1892); 'Birds in a Village' (1893); 'Idle Days in Patagonia' (1893); 'British Birds' (1895); 'Birds in London' (1899); 'Nature in Downland' (1900); 'Birds and Man' (1901); 'El Ombri' (1902); 'Hampshire Days' (1903); and with the publication of 'Green Mansions,' a remarkable romance of Venezuela (1904; new ed., New York 1916), it became known that in this author was, as expressed by John Galsworthy, «a simple narrator who is well-nigh unsurpassed, a stylist who has few, if any, living equals.» His later publications include ‘A Crystal Age’ (1906; new ed. 1916); ‘The Lands End’ (1908); ‘Afoot in England’ (1909); ‘A Shepherd's Life’ (1910); ‘Adventures Among Birds’ (1913; new ed., New York 1916); ‘Tales of the Pampas’ (1916).

HUDSON, Mass., town, Middlesex County, on the Assabet River, and on the Boston and Maine and the Fitchburg railroads, about 17 miles northwest of Worcester. The town is in an agricultural region, but is particularly noted for its manufactures of leather and rubber, gossamer clothing, webbing, goring and boots and shoes, paper and wooden boxes. The town owns and operates the electric-light plant and the waterworks. Pop. 6,743.

HUDSON, N. Y., city, port of entry, county-seat of Columbia County, on the Hudson River, and on the New York Central and Hudson River and the Boston and Albany railroads, about 30 miles south of Albany. Area of the city, one square mile. Hudson was settled in 1783 and was called Claverack Landing; but the year following the name was changed to Hudson. In 1785 it was chartered as a city, and in 1790 it was made a port of entry. From the first it was a trading station of importance and a whaling port. After the Revolution a large foreign trade was established, but the commerce of the city was injured by the destruction of its shipping in the War of 1812. The surrounding country is devoted largely to agriculture, and the city has a number of manufacturing establishments. The chief manufactures are foundry products, machinery, knit goods, car-wheels and creamery products. It has a large sash and blind factory and several small manufacturing establishments. Some of its prominent buildings are the State Volunteer Firemen's Home, the State House of Refuge for Women, an orphanage, hospital and the city public buildings. The city owns and operates the waterworks. The government is vested in a mayor, who holds office for two years, and a city council. Pop. 11,417.

HUDSON, Ohio, town in Summit County, on the Pennsylvania Railroad, 20 miles south of Cleveland. This was one of the earliest settled towns on the Ohio Western Reserve, and prior to the Civil War was an abolition stronghold. The Western Reserve College, before its removal to Cleveland, was located here. Pop. 1,021.

HUDSON, Wis., city and county-seat of Saint Croix County, on Lake Saint Croix, an expansion of the Saint Croix River, and on the Chicago, Saint Paul, Minneapolis and Omaha Railroad, 65 miles northwest of Eau Claire and 20 miles east of Saint Paul, Minn. The chief manufactures are railroad cars. The city has a saw-mill, interior finish factory, brewery, large cold-storage plant and ample facilities for shipping the butter, poultry, vegetables and fruits of the surrounding valuable farm lands. It has a large sanatorium, fine courthouse and the Galahad School for Boys. The electric-light plant and the waterworks are owned and operated by the city. Pop. 2,810.

HUDSON, the largest river in the State of New York, has its head waters in Hamilton and Essex counties, and flows southwest into Saratoga County, then nearly directly east to Sandy Hill in Washington County, and from this point south through New York Bay into the Atlantic Ocean. It is fed by several of the Adirondack lakes, a number of small streams, and by Schroon River, Batten Kill, Hoosick, Wappinger and Croton from the east, and the Sacandaga, Mohawk, Wallkill and Esopus Creek from the west. The Mohawk (q.v.), which flows into the Hudson at Cohoes, is the largest tributary; the Rondout enters the Wallkill near the Hudson. The head waters of the Hudson and the sources of several of the streams which flow into the Saint Lawrence are very near each other in the Adirondack Mountains. At Troy, three miles below the mouth of the Mohawk, the Hudson becomes a navigable tidal stream. There is a tidal rise of about one foot at Albany. Above Troy there are a number of rapids and long falls in the river; but below, the navigation is uninterrupted. At one time there were a few obstacles, the largest of which was «Overslaugh,» or Castleton Bar, at Castleton. This hindrance to navigation has been almost wholly removed by the Federal and State governments. The Catskill Mountains, on the west side, begin about 25 miles below Albany. Lower down are the Highlands, averaging about 1,100 feet in height, which extend along the shore for a distance of about 20 miles. The Highlands of the Hudson are noted for their beautiful scenery. On the west bank are the famous Palisades (q.v.) about 13 miles long, their southern extremity being near Fort Lee, in New Jersey, and the northern extremity near Piermont, N. Y. This remarkable arrangement of rock rises from near the water's edge, almost perpendicularly, from 350 to 550 feet. Below Verplanck and Stony Point is an expansion in the river, the upper part of which is called Haverstraw Bay and the lower part Tappan Sea. Many small islands in the river serve as foundations for lighthouses, or for the erection of dredging platforms. Iona, on which there is now a naval station, Constitution and Beeren islands have all figured in history. Below Albany the Hudson is more an estuary or fiord than a river, which accounts for the great depth of water. The area drained by the Hudson above where the Mohawk enters is about 30,000 square miles. The river is noted for its beautiful scenery from the source to the mouth. Along the lower part of its course there are many fine residences, as a large part of the country on both banks from New York to Albany is now a residential section. The Hudson is fittingly called the «Rhine of America.»

Hudson River was discovered by Verrazano, an Italian navigator, in 1524; but it was explored by Henry Hudson in 1609. The Indian name for the river was Shatemuc, and the first colonists called it North River, as the Delaware was then called South River. The part of the river west of New York city is still called North River; but it was given the name Hudson in honor of its first explorer. The history of the country since its discovery by Europeans occupies an important place in the history of the United States. The almost unbroken waterway from the Atlantic Ocean through what is now the State of New York, to the Saint Lawrence River, made this an important route for missionaries, traders and for the armies in the various wars. From the mouth of Lake Champlain to Lake George, across the portage from Lake George to the Hudson, and the Hudson to the ocean, was all disputed territory, and the scene of many a contest of the Revolutionary War. See CHAMPLAIN, LAKE; CROWN POINT; HAVERSTRAW; TICONDEROGA.

The river is navigable for ships of the first class for about 117 miles from the ocean. Its whole length is about 300 miles. Before the introduction of railroads, the navigable waters of the Hudson, connecting New York with a large section of country, gave the city great opportunities for development. A canal built along the Mohawk Valley, in 1817-25, connected the Hudson with Lake Erie, and the Champlain Canal completed the water route from the Hudson to Lake Champlain. Later the Erie and the Delaware and Hudson railroads brought the coal of Pennsylvania to the Hudson River for transportation by water to markets in the interior. The New York Central and Hudson River Railroad is on the east side of the river and the West Shore on the west side. In 1807 Robert Fulton made on this river the first successful experiment with steam navigation. The Hudson is now a thoroughfare for an immense amount of freight, and elegant passenger steamers ply daily between New York and Albany. The government has erected and maintains 21 lighthouses and lighted beacons. Navigation ceases in winter because the river is frozen nearly its whole length. The ice crop harvested each winter on that part of the river between Albany and the Highlands is shipped, when navigation opens, chiefly to New York city. Shad fishing is one of the important Hudson River industries. Many of the cities on the Hudson were at first only trading posts or ferry towns, but nearly all have kept pace in development with the rest of the State. The principal cities and towns on the river from north to south are Glens Falls, Sandy Hill, Fort Edward, Mechanicsville, Cohoes, Troy, Albany, Hudson, Catskill, Kingston, Poughkeepsie, Newburgh, West Point, Peekskill, Haverstraw, Ossining, Nyack, Tarrytown and Yonkers. At the mouth of the river are New York and Jersey City, with the suburbs, which are important shipping ports, Hoboken and Weehawken. The only bridge crossing the river between New York and Albany is the one which extends from Poughkeepsie on the east side to Highland on the west. There are 14 public ferries. The use of the water power of the Hudson as an aid in developing electrical power for the mechanical arts is most important. From Mechanicsville the power of the Hudson is transmitted to the General Electric shops of Schenectady. At Spiers Falls, at the foot of Mount McGregor, about 40 miles above Albany, there is a stone dam over 1,800 feet long, 100 feet high and containing 1,800,000 cubic feet of masonry. The Hudson is raised 50 feet above its former river bed, then its waters fall 80 feet, and the power developed is transmitted for electrical machinery to Schenectady, Albany, Troy, Amsterdam and other places. This power development of the waters of the Hudson combined with development of like power of the waters of the Saint Lawrence at Massena keeps the two rivers, as in early years of our country, of vast importance to the State. Many industries are affected by this great new power, not the least of which are the coal-mining of Pennsylvania and the preservation of the Adirondack forests.

The Hudson occupies an important place in the historical, commercial and mechanical development of the nation, also in its literary and artistic progress. Washington Irving who lived at «Sunny Side» and was laid to rest in Tarrytown, introduced to the world many of the places along the Hudson. Cro' Nest is associated with Joseph Rodman Drake and his poem, 'Culprit Fay'; West Park and the country around have been practice observation ground for the naturalists John Burroughs and Ernest Ingersoll; Cornwall-on-the-Hudson was the home of N. P. Willis and E. P. Roe. Artists who have received inspiration from Hudson's scenery and history have become sufficiently numerous and their works of importance enough to be called «The Hudson School of Painters.» Consult Johnson, C., 'The Picturesque Hudson' (New York 1909).

HUDSON BAY, Canada, an extensive bay or inland sea extending between lat. 51° and 64° N. and long. 77° and 95° W. Its greatest length north to south is about 800 miles, greatest breadth, 600 miles. It is connected with the Atlantic Ocean by Hudson Strait and with the Arctic Ocean by Fox and other channels. Hudson Bay is navigable in summer from the middle of June to the end of October, being obstructed by drift-ice during the rest of the year. There are many islands, reefs and sand banks. The white whale is found in its waters, and there is a considerable summer fishery, steam whalers frequenting the bay from the middle of June to the end of October. Numerous rivers flow into the bay, the chief being the Nelson and Churchill on the east. The shores on the east are high and bold; those on the west are low and level, and much of the land is favorable for stock and dairy farming, while valuable deposits of iron ore, galena and plumbago exist. With the exception of a few fur trading stations of the Hudson Bay Company on the west and south coast, there are, however, no settlements.

HUDSON RIVER SCHOOL OF PAINTING. See AMERICAN ART.

HUDSON STRAIT. See HUDSON BAY.

HUDSON'S BAY COMPANY, the great fur-trading and later landholding and administrative company of Northwest Canada, incorporated 1670. It originated in the dissatisfaction of two French Protestant employees of the French fur-trading monopoly at Quebec, Groseilliers and Radisson, over its unwillingness to extend the trade to Hudson Bay. After vainly trying to induce Boston merchants and the French court to take up their scheme for so doing, they gained the ear of a company of London merchants and Prince Rupert, cousin of Charles II; brought a load of furs from the bay; and on 2 May 1670 Rupert and 17 associates received from Charles a charter for «The Governor and Company of Merchants-Adventurers trading into Hudson's Bay.» It had the monopoly of the right to trade in the bay or on its coasts, and could expel any one entering the territory without its license; could build forts, send out ships of war and privateers and declare war and make peace with any non-Christian people. Its capital was £10,500, divided into 34 shares with an extra one for

Prince Rupert, and in 1676 it imported some £19,000 worth of furs, sending in return £650 worth of goods to the Indians. The profit was high on the petty capital paid in, but the gross amount was not large for a century. In 1748 the trade was carried on with four ships and employed about 120 men in all, including the garrisons at its forts. The furs and other imports amounted to over £30,000, the exported goods to £5,000 and the costs of business over £17,000. The average profit was 40 per cent on capital, but the sum was trivial. Moreover, the company had great losses and tribulations from the French rivalry and assaults, especially in the national wars. The French laid claim to the territory on the strength of a mythical expedition of Jean Bourdon in 1656, and in 1682 and 1686 captured several of the company's forts. The two countries' trading posts shared in the long war ended by the Peace of Ryswick in 1697, captured each other's forts, and the treaty yielded Port Nelson to the French, to the great damage of the company. The War of the Spanish succession inflicted frightful hardships on both sides; the company claimed a loss of over £100,000, hundreds of trappers and employees starved to death and the Indians turned cannibals. The Treaty of Utrecht in 1713 finally resigned all French claim to the Hudson's Bay territory and thence till the cession of French Canada in 1763, the monopoly gave the company an easy life and good profits, though still on a small scale. But when that cession opened up access to Hudson's Bay from both land and sea, the possibilities of trade were incalculably enlarged. Despite the clandestine rivalry of Montreal traders who intercepted their boats, the gross volume of trade increased, and it was not crippled by the ravages of France in 1782, as part of the war begun in 1778, when they captured and partly ruined the massive stone Fort Prince of Wales at the mouth of Churchill River and altogether destroyed property valued by the company at half a million pounds. But a much worse rivalry was at hand, organized and powerful: the Northwest Company (q.v.), started on a co-operative plan in 1784 by an association of Scotch merchants in Montreal. The Declaration of Rights having guaranteed free and open trade to all British subjects, this company invaded its rival's territory, and the trade competition for many years merged into actual war. In 1821 they had done each other so much harm that they consolidated, and Parliament in view of the evils of competition empowered the Crown to issue licenses for the «Indian territories,» which was exercised in favor of the new company. Meantime exploration had been steadily enlarging the territory; Samuel Hearne for the old company had reached the Arctic in 1771, Alexander Mackenzie for the new one reached the Pacific in 1793. With the United States, its rivalry for the far Northwest was strenuous and persistent; it planted posts in the Oregon district, repelled settlers and there was much danger of war till the boundary settlement of 1846 quieted the dispute. In 1849 it secured a grant of Vancouver Island. This was the time of its palmiest growth. In 1846 it had 513 employees and 35 officers, in 1856 it had over 3,000 employees and officers together, with 152 posts. Its trade monopoly expired by limitation in 1859, but there was also a great desire to settle the Northwest Territories, with which the fur-trade and administrative rights of the company were incompatible. The company, liable to be dispossessed by force if it refused to come to terms, agreed in 1869 to transfer its territorial rights to the Dominion of Canada for £300,000 and one-twentieth of the lands set out for settlement by the government for the next 50 years. It retained its posts and its rights of trade. The transfer to Canada, and the survey of lands for settlement, was immediately followed by the Riel rebellion (q.v.). The company, despite its lapse of administrative powers, remains the most potent influence for law and order in the unsettled parts, through its relations with the Indians. Consult Bryce, 'History of the Hudson's Bay Company' (1900); Willson, 'The Great Company' (1900); Cawston and Keane, 'Early Chartered Companies' (1896). For the Northwest Company, consult Irving, 'Astoria.'

HUÉ, hoo-ā, French Indo-China, the capital of Annam, on the river Truong, 10 miles from its mouth in the Gulf of Tonking. It is surrounded by Vaubanian fortified walls, five miles in circumference, the internal city being built on a rectangular plan with wide and straight streets. The chief building is the royal palace, containing a famous museum of ancient Annamite art, mainly in gold and jade jewelry. Hué is the seat of a French political resident, and at Thuan-an, the port at the river mouth, there is a French garrison. Pop. 60,600, of whom less than 400 are Europeans.

HUE AND CRY. (1) Formerly, the common-law process of pursuing criminals with loud outcry, in which all persons were bound to join and assist in the capture. (2) In recent usage, a proclamation for the finding of stolen goods or for the capture of a criminal; hence, any outcry or clamor of pursuit or the like. (3) In England, an official gazette for the information of the authorities as to criminals, crimes committed, etc. Under the process of hue and cry (definition 1) no proof was required of the guilt of the accused, and he had no right of appeal, but all statutes relating thereto were repealed in England in 1887 by the Sheriffs Act, which provided simply that every person in a county, at the command of the sheriff, must be ready to arrest a felon or be fined on failure to comply.

HUELEN, wā'lăn, Chilean hero: b. about 1540; d. 1603. He attained the command of the native forces in Araucania and was for a time successful in repelling the invading Spaniards, whose methods of warfare he copied. He defeated the enemy at Valdivia, near Concepción, and near Bio-Bio, but died during the siege of Osborno.

HUELVA, wăl'vą, Spain. (1) A maritime province in the southwest, bounded on the north by Badajos; on the east by Seville; south by the Gulf of Cadiz, and west by Portugal. The Sierra de Aracena cross the province in a southwesterly direction. The chief rivers are the Guadalquivir and the Gudiana, the Odiel and the Tinto, and several other tributaries of the main streams. The principal industries are the manufacture of bricks, pottery, soap, candles, flour, brandy and some agriculture. Mining, however, is the leading occupation, the minerals produced in greatest quantity being copper, manganese and iron. Area, 3,913 square miles. Pop. (est.) 340,560. (2) A city, capital of the province mentioned above. It is situated on the left bank of the Odiel River, about 10 miles from the Atlantic Ocean, and serves as a railroad centre. Originally a Carthaginian trading post, it fell into the hands of the Romans who colonized it. An interesting Roman aqueduct in good repair still survives. Other noteworthy features are the monastery of Santa Maria la Rabida near by, in which Columbus resided after his failure to interest King John of Portugal in his adventurous schemes; the colossal statue of Columbus, erected in 1892 to commemorate his sailing from the port there on his voyage of discovery, and several fine churches. The principal industry is the mining of copper and other minerals at the Rio Tinto mines. To facilitate exportation, excellent modern piers have been constructed at great effort and cost. There are also machine shops, shipyards and considerable trade in grain, fish, olives, grapes and cork. Pop. 34,492.

HUEPPE, hüp'pé, **Ferdinand**, German hygienist: b. Heddesdorf, Rhine Province, 24 Aug. 1852. He studied at the Friedrich Wilhelms Institut of Berlin and in 1890 became professor of hygiene in Prague University (Germany). His researches in bacteriology and disinfection have been extensive and important. He wrote 'Die Methoden der Bakterienforschung' (1885); 'Naturwissenschaftliche Einführung in die Bakteriologie' (1896); 'Handbuch der Hygiene' (1899); 'Wohrung und Gesundheit' (1912); 'Sport und Reizmittel' (1913), and other works.

HUERCAL-OVERA, war'kal ō-vä'ra, Spain, a town in the southeastern part, in the province of Almería, on the Lorca-Baza Railway, 16 miles from the Mediterranean coast. It is finely built, the chief edifice being the church. The rich silver, lead and copper mines of the Sierra de Almagrera in the neighborhood supply the town with considerable trade. Agriculture is carried on extensively in the vicinity. Pop. about 17,500.

HUERTA, wär'tạ, **Vicente Antonio García de la**, Spanish poet and literary critic: b. Zafra in Estremadura, 1734; d. Madrid, 1787. After studying at Salamanca, he went to Madrid, where he occupied the position of head librarian of the Royal Library. His first literary work of distinction was the tragedy 'Raquel,' which made its first appearance in 1778. He was a staunch upholder of the ancient traditions of Spanish literature and wrote with considerable force and skill. His principal works were his two volumes of poems, 'Obras poeticas' (1778-79), which were printed in 'Biblioteca de autores españoles' (Vol. LXI, Madrid 1869). He was also editor of 'Teatro español' (17 vols., Madrid 1784-85), a collection of old Spanish dramatists.

HUERTA, Victoriano, Mexican military officer and president: b. Colotlán, Jalisco, 23 Dec. 1854; d. El Paso, Tex., 13 Jan. 1916. He was a full-blooded Indian and prided himself on his ancestry. At the age of 17 he was made secretary to General Guerra and soon afterward was admitted to the military academy of Chapultepec. After graduation there he was attached to the topographical bureau of which he was chief for several years. He conducted many surveys throughout the country and as a result had a wider knowledge of Mexican topography than any of his countrymen. For his part in suppressing revolts of the Yaquis and Mayas, Huerta was promoted to the rank of brigadier-general. Huerta was greatly trusted by Porfirio Diaz, and when the latter deemed it advisable to resign the presidency and leave Mexico, it was Huerta who safely conducted the Diaz party to the port of Vera Cruz, where they embarked for Europe. During the Madero regime, Huerta was dispatched to suppress the insurgents led by Pascual Orozco. Felix Diaz, nephew of ex-president Porfirio Diaz, instigated a revolt against the Madero government in February 1913, within the capital city, where a violent conflict was waged for 10 days. Huerta, now a general of division, conducted the defense for the Maderistas. By the latter it was charged that he did not use his best efforts to suppress Diaz. At the end of the street battle Madero and his vice-president, José Pino-Suarez, were seized, and on 18 Feb. 1913 Huerta proclaimed himself provisional president of Mexico. Four days later Madero and Suarez were murdered while being transferred from one prison to another. The circumstances surrounding the murders have never been cleared up, but the general belief is that Huerta was at least a party to the deed, if not the prime instigator, and the world doubted him when he disclaimed responsibility. Public opinion in the United States was aroused and demands were made for intervention. President Taft, however, being about to leave office, wished to leave his successor full freedom of action and President Wilson discountenanced intervention but firmly refused to recognize Huerta as president of Mexico although several European nations, including Great Britain, had done so.

Huerta's regime was troubled from within. Three more or less independent revolutions were in full blast during 1913, led severally by Carranza, Villa and Zapata. The United States ambassador was recalled and John Lind, ex-governor of Minnesota, was sent as personal envoy of President Wilson to demand of Huerta that he permit a regular presidential election at which he would not be a candidate. Huerta refused and when the Congress set about investigating his autocratic action he caused the arrest of the members hostile to him, and, after dissolving the chamber, assumed full dictatorial powers. In April 1914 some members of the crew of the United States ship *Dolphin* were arrested at Tampico while seeking gasoline supplies on shore. Upon explanation of their errand by Admiral Mayo they were released but the admiral demanded an apology and a salute to the American flag. Huerta refused compliance with this demand and on 21 April Vera Cruz was bombarded by American warships, and landing parties of marines and sailors took the city after a sharp and decisive conflict with the Mexican forces. At this juncture Argentina, Brazil and Chile offered their services as mediators, but the subsequent "A. B. C." conference at Niagara was barren of result. Failure of recognition by the United States government greatly weakened Huerta's hold in Mexico; he resigned on 15 July; and within a short time set out for Spain. He left the latter country on 3 March 1916 and within a few weeks arrived in New York and established his family at Forest Hills, L. I. Soon afterward he set out for the southwest, but on 27 June was arrested at Newman, N. M., on the charge of fomenting a revolution against Mexico, a country then friendly to the United States. Huerta was released under bond, but on 3 July was rearrested at El Paso, just as he was preparing to enter Mexico. Thereafter until a few days before his death he was under guard at Fort Bliss. Many stories were circulated that German money was being used to put Huerta back in control in Mexico, but none of these was proved as he died before his trial, from acute sclerosis of the liver, aggravated by his hard-drinking habits.

HUESCA, wă'skạ, Spain. (1) A province of northern Spain, formed in 1833 of districts once belonging to Aragon; bounded on the north by France, west and southwest by Saragossa, southeast by Lérida and northwest by Navarre. The Pyrenees traverse the northern part, reaching an altitude at Monte Perdido of 10,997 feet. The principal rivers are the Aragon in the northwest; the Gallego in the west; the Noguera Ribagorzana in the east, and the Cinca in the centre. Agriculture and cattle raising are the chief industries. The forests are abundant and there is considerable mining of lead, copper, iron, salt, cobalt, limestone and granite. Some manufactures of soap, leather, pottery and cloth are also carried on. The chief towns are Huesca, the capital, Jaca, Barbastro and Fraga. Area, 5,848 square miles. Pop. (est.) 249,265. (2) A city, capital of the province of the same name, on the river Isuela, 45 miles northeast of Saragossa, with which it is connected by rail. It is a very old town, as its many winding streets, mediæval houses and ancient walls testify. The important buildings are the splendid Gothic cathedral dating from the 15th century; the church of San Pedro, in the Romanesque style, dating from the 12th century; and the former university edifice, occupied by a secondary school since 1845, when the university took up its headquarters at Saragossa. Huesca is the seat of a bishop and the episcopal palace is another fine structure. Manufactures of cloth, pottery, bricks and leather are carried on and there is important trade in wine and produce. Under the name of Osca it was an important town in Roman days. Sertorius founded a school there for native chiefs. It was later the scene of the death of Sertorius at the hands of Perpenna (72 B.C.). Under the Moors it was strongly fortified in the 8th century, but in the 11th it was regained by Pedro I of Aragon and became the capital of Aragon. In the following century, with the removal of the capital to Saragossa, it began to decline in prestige.

HUÉSCAR, wā'skär, Spain, a city in the province of Granada, 75 miles northeast of the city of the same name. The principal manufactures are flour, paper, linen and woolens. Pop. about 9,000.

HUET, u-ā', **Pierre Daniel**, French Roman Catholic scholar: b. Caen, 1630; d. Paris, 1721. After studying at the Jesuit school at Caen, he went to Paris in 1651. In the following year his friend and teacher, Samuel Bochart, was invited to the court of Queen Christina at Stockholm, whither Huet accompanied him. Here he conceived the plan for his edition and translation of Origen which appeared in 1668. By indefatigable efforts he mastered many scientific studies, and gained also a most comprehensive knówledge of languages and literature. In 1670 he was appointed assistant tutor to the Dauphin and in this capacity contributed largely to preparation of the Delphine classics. In 1676 he took holy orders, and two years later he was given the abbey of Aulnay. His famous 'Demonstratio evangelica' was published in 1679. As abbot, he published 'Alnetanæ Quæstiones de Concordia Rationis et Fidei' (1690); 'Censura philosophiæ Cartesianæ' (Paris 1689), and also his 'Nouveau mémoire pour servir à l'histoire du Cartésianisme' (1692), and his discussion with Boileau on the Sublime. In 1685 he was created bishop of Soissons, which office, however, he never filled, being transferred to Avranches in 1692. After serving as abbot of Fontenay for a short period, he withdrew to the Jesuits' House at Paris, where he spent his last days. Huet was conceded to be one of the most versatile and brilliant minds of his period. He left a huge library which eventually became incorporated in the royal library. A collection of his works was published in 1712, and 'Huetania,' a volume containing many of his essays and miscellaneous writings, was edited by the abbot of Olivet (1722). In his 'Commentarius de rebus ad eum pertinentibus' was found his autobiography, since translated into French, and into English by J. Aiken (2 vols., London 1819). Consult de Gournay, F. A., 'Huet, Evêque d'Avranches, sa vie et ses œuvres' (Paris 1854); Trochon, 'Huet, Evêque d'Avranches' (ib. 1877).

HUFELAND, hoo'fẹ-länt, **Christoph Wilhelm**, German physician: b. Langensalza, 12 Aug. 1762; d. Berlin, 25 Aug. 1836. His father was court physician to the Grand Duchess of Weimar, at which city the younger Hufeland received his preliminary education. Later (1780) he studied at Jena and at Göttingen, becoming professor of medicine at the former institution in 1793. In the same year he succeeded his father as court physician at Weimar. Five years later he established himself at Berlin. He was professor of therapeutics and pathology at the university from 1810, became councillor of state in the same year and was prominent in state medical affairs. His reputation was unequaled in his time. Of his many excellent medical writings, the most widely known are his 'Makrobiotik' ('The Art of Prolonging Life') which was translated into a number of European tongues; 'System der praktischen Heilkunde,' a practical work; 'Über die Ursachen, Erkenntnis und Heilart der Skrofelkrankheit' (1795); 'Guter Rath an Mütter über die wichtigsten Punkte der physischen Erziehung der Kinder' (1799); 'Enchiridion Medicum' (1836). His autobiography was published in 1863.

HUFELAND, Gottlieb, German political economist and lawyer: b. Dantzig, 19 Oct. 1760; d. Halle, 25 Feb. 1817. He received his education at Leipzig, Göttingen, and finally at Jena, where he was appointed extraordinary professor of law in 1788 and full professor in 1793. His expositions of the Kantian ideas of legislation won him considerable reputation and attracted many students to his lectures. In 1830, Hufeland became professor of law at Würzburg, but remained only a short time, and then accepted a call to Lanshut. From 1808–12 he was burgomaster at Dantzig. In 1813 he returned to Landshut, where he remained for three years and left to resume work at Halle. His legal works include ‘Versuch über den Grundsatz Naturrechts’ (1785); ‘Lehrbuch des Naturrechts’ (1790); ‘Lehrbuch der Geschichte und Encyclopädie aller in Deutschland geltenden positiven Rechte’ (1790); ‘Institutionen des gesammten positiven Recht’ (1798); and his greatest work ‘Neue Grundlegung der Staatswirthschaftskunst’ (2 vols., 1807–13).

HUFFCUT, Ernest William, American lawyer and educator: b. Kent, Conn., 1860; d. 1907. He studied law at Cornell University, being graduated in 1888. He then established a practice in Minneapolis, Minn. (1888–90), which he abandoned for the chair of law at Indiana University (1890–92). From 1892–93 he taught at Northwestern University, and from the last-mentioned year was dean of the Cornell Law School. He was appointed legal adviser to Governor Hughes at the beginning of his first term (1907), but shortly afterward he suffered a nervous breakdown and committed suicide. His publications include ‘American Cases on Contract’ (1884; 3d ed., 1913); ‘Cases on the Law of Agency’ (1896, with Woodruff), and ‘Elements of Business Law’ (1905), which is still a standard textbook on the subject.

HUG, hoog, **Johann Leonhard,** Roman Catholic scholar: b. Constance, 1 June 1765; d. Freiburg, 11 March 1846. After studying at Freiburg he was ordained in 1789. Two years later he received the appointment of professor of Oriental languages and of the Old Testament and New Testament exegesis (from 1792) at Freiburg. Here he remained for the rest of his life, except for short sojourns at other universities where he participated in the organizing of new courses; and for travel on the Continent in pursuance of his literary labors. He attained great eminence as a political scholar, his works including ‘Erfindung der Buchstatenschrift’ (1801); ‘De Antiquitate Codicis Vaticanæ Commentatio’ (1810); ‘Das hohe Lied’ (1813); ‘De Pentateuchi Versione Alexandrina Commentatio’ (1818); ‘Gutachten über das Leben Jesu, kritisch bearbeitet von D. Fr. Strauss’ (1835), and his most widely-known ‘Einleitung in die Schriften des Neuen Testaments’ (1808), which was translated into English and French. It is an important contribution to the history of Bible versions. Consult Werner, K., ‘Geschichte der Kathologischen Theologie in Deutschland’ (Munich 1867).

HUGER, ū-jė, **Francis Kinloch,** American soldier: b. Charleston, S. C., September 1773; d. there, 14 Feb. 1855. He was a nephew of I. Huger (q.v.). His father, Maj. Benjamin Huger, was killed before the lines of Charleston in 1779. He studied medicine in London and Vienna where he became acquainted with Dr. Eric Bollman whom he joined in an attempt to rescue Lafayette (q.v.) from the dungeons of Olmütz, his father having been the first to receive that general on his arrival in Georgetown in 1777. The enterprise resulted in their imprisonment for eight months. After his liberation he went to Philadelphia where he continued his medical studies at the University of Pennsylvania from which he received the degree of M.D. in 1797. A bronze tablet was erected in the Medical Hall of this institution in his memory in 1909. Huger became a captain in the United States army in 1798, was a colonel in the War of 1812 and served in both branches of the legislature of his State. Consult Headley, P. C., ‘Life of General Lafayette’ (New York 1855); Lafayette, M. J., Marquis de, ‘Memoirs, Correspondence and Manuscripts of General Lafayette’ (3 vols., London 1837); Quincy, J., ‘Figures of the Past’ (Boston 1883); University of Pennsylvania, ‘Memorial to F. K. Huger, etc.’ (Philadelphia 1909); Varnhagen von Ense, K. A., ‘Denkwürdigkeiten und Vernischte Schriften’ (Vol. IV, Leipzig 1843).

HUGER, Isaac, American general: b. Limerick Plantation, S. C., 19 March 1742; d. Charleston, S. C., 17 Oct. 1797. He was one of five patriot brothers active in the Revolution, beginning his military service as lieutenant-colonel in 1775, after having participated in 1760 in the expedition against the Cherokees. Promoted to the rank of brigadier-general in 1779, he took a conspicuous part in the engagements connected with the siege of Savannah in 1779, commanded a force of cavalry at the siege of Charleston in 1780 which was surprised and dispersed by Tarleton, and commanded the Virginia brigade which formed the right wing in the battles of Guilford Courthouse and Hobkirk's Hill in 1781. He was wounded in 1779 at Stono Ferry and again in 1781 at Guilford, but recovered and served until the end of the war.

HUGGINS, hŭg'ĭnz, Sir **William,** English astronomer: b. London, 7 Feb. 1824; d. there, 12 May 1910. He was educated at City of London School, and in 1856 erected an observatory at Tulse Hill, in northeastern Surrey. When in 1859 Professor Kirchoff of the University of Heidelberg announced the true interpretation of the dark Fraunhofer lines in the solar spectrum, Huggins at once saw the possibility of using his practical knowledge of chemistry and physics in the service of astronomy. With W. A. Miller, professor of chemistry at King's College, London, he at once set about the task of constructing a star-spectroscope. The two then began the observation of stellar spectra. A full statement of their results was read before the Royal Society in 1864, the essence of the statement being, in Huggins' own words, that the chemistry of the solar system prevails, essentially at least, wherever a star twinkles. In August 1864 Huggins directed his star-spectroscope toward a planetary nebula in Draco and found its spectrum to be a monochromatic one, thus proving that the nebula consists of a luminous gas. In 1868 he was able to announce to the Royal Society the results of his first measurements of the motion of stars in the line of sight. He began his observations of comet spectra with that of Winnecke's comet in 1868, and in 1868–69 made spectroscopic observations of the solar prominences. About 1876 he resumed his abandoned efforts to photograph stellar spectra, using the gelatine dry plate process then recently introduced, and this time he was completely successful. His photographs of the invisible ultra-violet portions of stellar spectra have proved extremely valuable, providing, for example, the only reliable data for determining the relative ages of the stars. He was awarded successively the Royal, Rumford and Copley medals of the Royal Society; was president of the Royal Astronomical Society 1876–78 and of the Royal Society 1900–06, was created K.C.B. in 1897, and was (1902) one of the original recipients of the Order of Merit. In his wife (née Margaret Murray) whom he married in 1875, he had a valued coadjutor, and with her published in 1900 a valuable ‘Atlas of Representative Stellar Spectra.’

HUGH, hū, **Saint**, of Avalon, bishop of Lincoln: b. about 1140; d. London, 16 Nov. 1200. When Hugh was a young child, about eight years old, his father, Lord of Avalon, retired with him to the monastery at Villard-Benoîtt near Grenoble. Here he received his early training; and when he became 19, undertook the duties of deacon. In 1160 Hugh became attracted to the Carthusian order, and joined their ranks at the Grande Chartreuse. He was appointed procurator of that order, and in this capacity gave evidence of that fine administrative ability and tact which induced Henry II to request him to undertake the establishment of a Carthusian monastery at Witham, Somerset. His great success in this work secured his elevation to the bishopric of Lincoln at the favor of the same monarch. However, in spite of the king's patronage, Hugh remained fearless and independent, often opposing his ruler on matters which seemed to him worthy of his championship. He attended rigidly to his ecclesiastical duties, avoiding participation in secular affairs. His benevolence and kindliness endeared him to the people of his see, and made him an object of universal respect and admiration. On his return from a visit to his native monastery, he became ill and died. He was buried in Lincoln Cathedral, and his tomb became a shrine for pilgrims. Hugh was canonized on 17 Feb. 1220. His day in the Roman Catholic calendar is 17 November. His ‘Life’ in Latin, doubtless written by Adam, the bishop's chaplain, was edited by Dimock (London 1864; Eng. trans. by Perry, ib. 1879). Consult ‘Vie de Saint Hugues, évêque de Lincoln (1140–1200) par un religieux de la Grande Chartreuse’ (Montreuil 1890; Eng. trans. by H. Thurston, London 1898).

HUGH, king of Provence and Italy: flourished in the 10th century; d. 947. The son of Lothair, Count of Arles, he was chosen ruler of Provence to succeed Louis the Blind (923). He was also given the crown of Italy by the revolted subjects of Rudolph. His reign was occupied with attempts to maintain his position. Revolts and insurrections were rampant throughout the kingdom and Hugh himself was driven out of Italy by Berengar.

HUGH CAPET, king of France, founder of the Capetian dynasty. See Capet.

HUGH OF LINCOLN, Saint, a child who is the central figure of a popular mediæval story. He was a boy of 10 when he was found murdered on the premises of a Jew. Another version makes Hugh guilty of having thrown a ball through the window of the house of a Jew who murdered the boy for his crime. The name of the murderer was revealed to the mother by the child himself, who spoke to her from the well into which his body had been thrown. The belief that Jews were wont to kill Christian children at Passover time was current throughout the Middle Ages, and many Jews were made to suffer bitter persecution because of this superstition. The story of Hugh is treated in Chaucer's ‘Prioress's Tale’ and by Marlowe in the ‘Jew of Malta.’

HUGHENDEN, hū'ĕn-dĕn, England, a parish of Buckinghamshire, two miles north of High Wycombe. It is known principally for Hughenden Manor, where Benjamin Disraeli, Earl of Beaconsfield, lived, and for the parish church in which the Earl and his wife are buried. Pop. 2,150.

HUGHES, Ball, American sculptor: b. London, 19 Jan. 1806; d. Boston, Mass., 5 March 1868. He early exhibited a decided taste for modeling and at 12 years of age made out of wax candle ends a bas-relief copy of a picture representing the wisdom of Solomon, which was afterward cast in silver. He was then placed in the studio of Edward Hodges Bailey, where he remained seven years. At this time he successfully competed for the prize awarded by the Royal Academy, winning the large silver medal for the best copy in bas-relief of the Apollo Belvedere; also the silver medal from the Society of Arts and Sciences for a copy of the Barberini faun, the large silver medal for the best original model from life and a gold medal for an original composition, «Pandora brought by Mercury to Epimetheus.» He emigrated in 1829 to New York, where his first work of importance was a marble statue of Hamilton, for the Merchants' Exchange, which was destroyed by fire in 1835. He also made a life-size statue of Bishop Hobart for the vestry of Trinity Church. Soon afterward he moved to Dorchester, Mass. Among later works of his are the bronze statue of Bowditch at Mount Auburn Cemetery, a bust of Washington Irving and a statuette of General Warren at Bunker Hill. A plaster figure, ‘Little Nell,’ and a group, ‘Uncle Toby and Widow Wadman,’ are in the Boston Athenæum.

HUGHES, Charles Evans, American jurist: b. Glens Falls, N. Y., 11 April 1862. He attended the public schools and Madison, now Colgate, University, 1876–78, and was graduated from Brown University in 1881; he then taught Greek and Latin in the Delaware Academy, Delhi, N. Y., studying law at the same time. In 1882 he went to New York city, where he continued to study law. He received honorary degrees of LL.D. from Brown in 1906, from Columbia, Knox and Lafayette in 1907, from Union and Colgate in 1908, from George Washington University, Washington, D. C., in 1909, from Williams, Harvard and Pennsylvania in 1910, and from Yale in 1915. He studied law in the office of Gen. Stewart L. Woodford and in the Columbia Law School, from which he was graduated with the degree of LL.B. in 1884; he was admitted to the bar the same year and practised in New York city. He won the prize fellowship at Columbia Law School and was a Fellow 1884–87; he was a member of the firm of Carter, Hughes & Cravath, 1887–91; professor of law at Cornell University, 1891–93; special lecturer, 1893–95, and also a special lecturer at the New York Law School, 1893–1900. He returned to his old law practice in New York as a member of his old firm, which became Carter, Hughes & Dwight, and in 1904, on the death of Mr. Carter, the firm became Hughes, Rounds & Schurman. In 1905 he was made counsel for the legislative committee, headed by Senator Stevens, appointed by the New York State legislature to investigate the Consolidated Gas Company and the price of New York city gas, and he framed the 80-cent gas and the assault proof bills, which became laws. In the same year, while in Europe, he was recalled to act as attorney for the Armstrong legislative insurance committee, and drew up a set of insurance laws which were adopted and which have meant the effective stoppage of waste and theft which had run into millions of dollars annually. In 1906 he was appointed special assistant to United States Attorney-General William Henry Moody, in the investigation of the coal trust; in the same year he was nominated for governor of New York State on the Republican ticket and was the only Republican candidate elected on the ticket, defeating William Randolph Hearst, the Democratic nominee, and was re-elected in 1908. In 1908 Governor Hughes was regarded as a possible candidate for President of the United States as successor to Theodore Roosevelt, the delegates from New York giving him a complimentary vote in the convention. On 25 April 1910 he was appointed by President Taft an associate justice of the United States Supreme Court. He was sworn in 10 Oct. 1910, and was succeeded as governor by Lieut.-Gov. Horace White, who served the remaining three months of the term. As governor he gave to New York State one of the most efficient administrations in its history. He carried many of his measures against the strong opposition of the legislature and other political forces, by gaining for them popular opinion through speeches made throughout the State. The most important amongst them were: Creation of State Probation Commission, Public Service Commissions, State Highway Commission, New Apportionment Act, Anti-Race Track Gambling Act, Direct Primary Law. During his administration the State also celebrated in a worthy manner the tercentenary of the discovery of Lake Champlain and of the Hudson River. He resigned from the United States Supreme Court after having been nominated on 10 June 1916 by the Republican National Convention for the presidency. After his defeat by President Wilson in November of that year he returned to the practise of his profession. After the entrance of the United States into the World War, he was appointed chairman of the New York District Board of Exemption. In the spring of 1918 President Wilson placed in his hands the investigation of supposed irregularities in connection with the building of airplanes for the United States army and navy, and he submitted his findings to the President October 1918. He is a member of the American, New York State and New York city bar associations, a Fellow of Brown University, a trustee of Chicago University and of the Rockefeller Foundation, and president of the Legal Aid Society. His speeches have been published as 'Addresses of C. E. Hughes' (revised ed., New York 1916); his messages, etc., as governor of New York have been collected as 'Public Papers of C. E. Hughes, Governor, 1907–10' (Albany 1908–10). He has also published 'Conditions of Progress in Democratic Government' (Yale Lectures on the Responsibilities of Citizenship, New Haven 1910). Consult Ransom, W. H., 'Charles E. Hughes, etc.' (New York 1916).

HUGHES, David Edward, English-American inventor: b. London, 16 May 1831; d. there, 22 Jan. 1900. When very young came with his parents to the United States, of which he became a citizen. He was educated at Saint Joseph's College, Bardstown, Ky., where he was appointed professor of music (1850) and later of natural philosophy. In 1855 he patented his first important invention, that of the well-known printing telegraph which bears his name. It was at once adopted in America, and by 1876 by practically every European country. In 1877 he settled in London. In 1878 Hughes announced to the Royal Society his invention of the microphone, an ingenious instrument which not only transmits sound, but so magnifies faint sounds as to make them distinctly audible. The microphone is now in universal use in the telephone. Another important invention, that of the induction balance, was completed by Hughes in 1879, and in 1880 he was elected a Fellow of the Royal Society, which awarded him its gold medal in 1885. He was a member and at times an officer of the Society of Telegraph Engineers (now Institution of Electrical Engineers), and a manager and vice-president of the Royal Institution. In his later years he experimented along the lines which some years later led to the discoveries of Hertz, Branly and Marconi, resulting in wireless telegraphy. He left a large fortune which was divided among four London hospitals and a number of scientific bodies. A list of his scientific papers will be found in Royal Society of London, Catalogue of Scientific Papers. Consult Anon., 'D. E. Hughes' (in *Nature*, Vol. LXI, p. 325, London 1900).

HUGHES, Edwin Holt, American Methodist Episcopal bishop: b. Moundsville, W. Va., 7 Dec. 1866. After studying at the Ohio Wesleyan University and the theological department of Boston University, he became pastor at Newton Centre, Mass. (1892–96) and at Malden, Mass. (1896–1903). In the last-mentioned year he was appointed president of De Pauw University, Greencastle, Ind., which position he occupied for five years, when he was called to the bishopric, with his residence at San Francisco. He was elected president of the State Teachers' Association of Indiana for the year 1904. His publications include 'Letters on Evangelism' (New York 1906); 'Thanksgiving Sermons' (1909); 'The Teaching of Citizenship' (1909); 'A Boy's Religion' (1914); 'The Bible and Life' (1914); Hauréau, J. B., 'Les Œuvres de Hugues de Saint Victor' (Paris 1886); Harnack, 'Dogma' (Vol. VI).

HUGHES, Hugh Price, English Wesleyan clergyman: b. Carmarthen, 8 Feb. 1847; d. London, 17 Nov. 1902. He was educated at University College, London, and the Wesleyan Theological College, Richmond; was appointed to Dover in 1869 and was afterward at Brighton; Stoke-Newington; Mostyn Road, London; Oxford; Brixton Hill; and the West London Mission. From 1885 he was editor of the *Methodist Times,* and he was also at one time president of the national council of Evangelical free churches. He was prominently identified with reform work in London and with the Anti-gambling League. He was a powerful preacher, possessing great personal magnetism, and politically a radical. Among his writings are 'Social Christianity' (London 1889); 'The Atheist Shoemaker' (London 1889); 'The Philanthropy of God' (London 1890); 'Ethical Christianity' (London 1892); 'Essential Christianity' (London 1894); and 'The Morning Lands of History: A Visit to Greece, Palestine and Egypt' (London 1901). Consult Hughes, D. P., 'The Life of Hugh Price Hughes' (London 1904); Mantle, T. G., 'Life of H. P. Hughes' (London 1903); Robinson, J. A., and others, 'Hugh Price Hughes As We Knew Him' (London 1902); Stead, W. T., 'H. P. Hughes and His Work' (in *Review of Reviews,* Vol. IV, p. 279, New York 1891–92).

HUGHES, John, American Roman Catholic prelate: b. Annaloghan, County Tyrone, Ireland, 24 June 1797; d. New York, 3 Jan. 1864. His parents were poor but made sacrifices to give him the opportunity of acquiring an elementary education; and by his own efforts he continued his studies so that when he came with his parents to America in 1817 he was prepared for college. However, for lack of means he had to defer entering any school, and instead began work as a day laborer, in which occupation he continued for three years, but at 23 entered the Roman Catholic Theological Seminary, Mount Saint Mary's, Emmitsburg, Md. As a student, his remarkable power of reasoning and his ability in argument attracted attention. He was ordained priest in 1826, and for a time was stationed at Bedford, Pa., from which he was transferred to Philadelphia. Here he had charge of Saint Joseph's parish and later Saint Mary's parish. In 1838 he was consecrated titular bishop of Basileopolis and appointed coadjutor to the bishop of New York. In 1842, after the death of Bishop Du Bois, he was made bishop of New York. In 1850 the diocese of New York became an archdiocese and on 19 July 1850 he was raised to the dignity of first archbishop of New York, which office he held until his death. He was an active and effective worker. As a speaker or writer he was ever ready to defend the Church which he represented. He was a resourceful controversialist, a powerful preacher, and, even though he was one of the most ardent supporters of the Pope and a faithful son of Ireland, he became a strong and sincere believer in the truth and desirability of American freedom and of American institutions. He established Saint John's Orphan Asylum in Philadelphia and a number of charitable and educational institutions in New York. The "school question" was to him all important. One of his first undertakings was to establish a theological seminary at La Fargeville in Jefferson County, N. Y.; the distance from New York caused the abandonment of this plan, and Saint John's College (q.v.) was founded at Fordham instead. In 1858 he laid the corner stone of Saint Patrick's Cathedral. In 1861, being a bold and strong supporter of the Union cause during the Civil War, he was sent by the United States government to Europe, to present the cause of the Union and counteract any adverse sentiment which might exist against the attitude of the North. His diplomatic mission was most successful in France, Italy and Ireland. After his return, though in feeble health, he promptly responded to official appeals to use his influence toward the breaking up of the Draft Riots (q.v.) in New York city. His remains were at first buried in Old Saint Patrick's, Mott street, but in 1883 were transferred to the new cathedral, whose founder he was, where they were laid to rest under the sanctuary. Of his controversial speeches the following were published: 'A Discussion of the Question, "Is the Roman Religion . . . Inimical to Civil or Religious Liberty?"' (Philadelphia 1836); 'Controversy between Rev. Messrs. Hughes and Breckenridge' (Philadelphia n.d.); 'The Controversy between Senator Brooks and John, Archbishop of New York, etc.' (New York 1855); his sermons, speeches, etc. were collected by L. Kehoe, 'Complete Works of John Hughes, Archbishop' (2 vols., New York 1866). Consult Brann, H. A., 'The Most Rev. John Hughes, First Archbishop of New York' (New York 1892); Farley, J. M., 'History of Saint Patrick's Cathedral' (New York 1908); Hassard, J. R. G., 'Life of the Most Rev. John Hughes' (New York 1866); Meehan, T. F., 'Archbishop Hughes and the Draft Riots' (in United States Catholic Historical Society, Historical Records and Studies, Vol. I, part 2, p. 171, New York 1900); Shea, J. G., 'History of the Catholic Church in the United States' (4 vols., Akron 1886–92); Smith, J. T., 'The Catholic Church in New York' (2 vols., New York 1905).

HUGHES, Rupert, American novelist: b. Lancaster, Mo., 31 Jan. 1872. He received his education at Adelbert College (Western Reserve University) and took graduate work at Yale, where he received his M.A. in 1899. He was assistant editor of *Godey's Magazine, Current Literature* and *The Criterion;* and then served for four years in London and New York on the staff of the 'Encyclopedia Britannica.' His published works include a number of books for children, also 'The Musical Guide' (1903); 'Love Affairs of Great Musicians' (1903); 'Songs by Thirty Americans' (1904); 'The Gift-Wife' (1910); 'Excuse Me' (1911); 'The Lady Who Smoked Cigars' (1913); 'What Will People Say?' (1914); 'Music Lovers' Cyclopedia' (1914); 'Empty Pockets' (1915); 'Clipped Wings' (1916); 'The Thirteenth Commandment' (1916); 'In a Little Town' (1917); 'We Can't Have Everything' (1917); 'The Unpardonable Sin' (1918); and a number of successful plays, the most well known of which are 'The Wooden Wedding' (1902); 'Alexander the Great' (1903–04). In 1918, he was commissioned a captain in the National Army.

HUGHES, Sir Sam, Canadian soldier and statesman: b. Darlington, County Durham, Ontario, 8 Jan. 1853. He completed his education at Toronto University; was lecturer in English language, literature and history at Toronto Collegiate Institute, and resigned in 1885; proprietor and editor of the *Lindsay Warder*, 1885–97; has been member of the Canadian House of Commons since 1892; and was appointed Minister of Militia and Defense 1911. The outbreak of the European War imposed on him the task of organizing a huge volunteer force; to this task he bent himself with characteristic energy, and in the first 20 months of the war an army of 320,000 was raised for overseas service. Sir Sam served in the Fenian raid of 1870 and in the South African War 1899–1900. He was created K.C.B. in 1915.

HUGHES, Thomas, English author: b. Uffington, Berkshire, 20 Oct. 1823; d. Brighton, Sussex, 22 March 1896. He was educated at Rugby and Oxford, later studied law at Lincoln's Inn, was called to the bar of the Inner Temple in 1848, and began practice at once. In 1869 he was appointed queen's counsel, in 1882 County Court judge. Throughout his long public career, as advanced Liberal in Parliament (1865–74), as president of the Working Men's College in London, as a champion of the coöperative movement, as founder with Canon Kingsley and Frederick Maurice of the Christian Socialists and as creator of Rugby, a socialistic community in the mountains of Tennessee (1880), he tried most earnestly to exercise a helpful influence upon English working-people. He early essayed journalism, writing many sketches for the London *Spectator*, chiefly accounts of traveling experiences. These sketches served as his apprenticeship in writing, and afterward were collected in book form with the title 'Vacation Rambles' (1895). But authorship was a secondary interest until 'Tom Brown's School Days,' first appearing in 1856, made him famous. This work is largely a presentation of the influence of Dr. Thomas Arnold (q.v.) in the great public school. 'The Scouring of the White Horse' (1858), a spirited account of a vacation trip, had a respectful although less cordial reception. The great success of the first story led him to continue his hero's career with 'Tom Brown at Oxford' (1861), first published serially in *Macmillan's Magazine*. At the time of the American Civil War, Hughes was a decided abolitionist, and thus established a friendship with James Russell Lowell. Among other works of his are 'Alfred the Great' (1869); 'Life of Livingston'; 'Memoir of a Brother'; 'Macmillan the Publisher' (1882); 'Life of Bishop Fraser' (1887); 'Vacation Rambles' (1895).

HUGLI, or HOOGHLY, hoog'lĭ, British India, (1) a district in Bengal in the Burdwan division along the river Hugli (q.v.). The principal railway is the East Indian. Transportation is carried along the Hugli, the Damodar and Rupnarayan rivers; and the Eden Canal irrigates the country between. The chief occupations are the manufacture of brass and bell metal. Flour mills, a bone-crushing mill and brick and tile works are also active industries. Area, 1,190 square miles; pop. 1,060,000. (2) A town, capital of the district of the same name, on the west bank of the Hugli, 24 miles north of Calcutta, with which it is connected by rail. With Chinusra, an old Dutch settlement, it forms one municipality. Hugli was founded by the Portuguese in 1537, who established a fort at Gholghat, which formed the nucleus of the present city. The principal buildings are the mosque, Hooghly College, a Mohammedan college, several high schools and a hospital. The manufactures consist of jute-bagging, bags and oil. Pop. about 25,000.

HUGLI, or HOOGHLY, British India, a channel which connects the Ganges with the Bay of Bengal. The group of rivers known as the Nadia rivers, i.e., the Jalangi, the Bhagirathi and the Churni form the Hugli by their confluence. The Hugli itself measures 125 miles and its estuary 35 miles. Its importance is due to the fact that it is the most navigable of the channels of the Ganges. The peculiarities of the tide in the river make it an object of physiographical interest. The tide in the dry season is felt about 17 miles above Calcutta; while during the southwest monsoon it is subject to a bore seven feet high and ascends rapidly at the rate of 22 miles an hour. The shoals at the mouth of the river demand constant dredging. It is navigable as far as Calcutta to boats drawing 26 feet of water. Above Calcutta the constant silting has rendered it unnavigable.

HUGO, Gustav von, German jurist: b. Lörrbach, Baden, 1764; d. Göttingen, 15 Sept. 1844. He studied law at Göttingen for three years and in 1786 was appointed tutor to the Prince of Anhalt-Dessau (1786). Two years later, he was called to the chair of law at Göttingen, becoming professor ordinary in 1792. His principal contribution to the study of law is in his application of the historical method to the great unsifted mass of legal matter which had been handed down by Roman legislators. His name ranks with Savigny and Haubold as one of the founders of this method. His important writings in this field are 'Lehrbuch eines civilistischen Kursus' (7 vols., 1792–1821); and 'Civilistisches Magazin' (1790–1837), together with its supplement 'Beiträge zur civilistischen Bücherkenntnis der letzten vierzig Jahre' (1828–45). Consult Eyssenhardt, 'Zur Erinnerung an Gustav Hugo' (Berlin 1845).

HUGO, hū'gō (Fr. ü'gō), **Victor Marie,** French poet and novelist: b. Besançon, 26 Feb. 1802; d. Paris, 22 May 1885. Major Hugo, his father, having entered the service of Joseph Bonaparte, king of Italy and afterward of Spain, Victor's earlier years were partly spent in these countries. At the age of 12 he was already writing verses of considerable promise, and in 1823 his first novel, 'Han d'Islande,' appeared, followed in 1825 by 'Bug Jargal.' In 1828 a complete edition of his 'Odes et Ballades' appeared. In these productions Hugo's anti-classical tendencies in style and treatment of his subject had been very visible, but the appearance of his drama, 'Cromwell' (1827), with its celebrated preface, gave the watchword to the anti-classical or romantic school. 'Cromwell' was too long for representation, and it was only in 1830 that 'Hernani,' over which the great contest between Classicists and Romanticists took place, was brought on the stage. Other dramas followed — ‘Marion Delorme’ (1831); ‘Le Roi s'amuse’ (1832); ‘Lucrèce Borgia’ (1833); ‘Marie Tudor’ (1833); ‘Angelo’ (1835); ‘Ruy Blas’ (1838); ‘Les Burgraves’ (1843). During those years he had also published a novel, ‘Notre Dame de Paris’ (1830), and several volumes of poetry, ‘Les Feuilles d'Automne’ (1831); ‘Les Chants du Crépuscule’ (1835); ‘Les Voix intérieures’ (1837); ‘Les Rayons et les Ombres’ (1840). The poetry of this period has a melody and grace superior perhaps to any that he afterward wrote, but wants that deep and original sense of life characteristic of his later poems. During the same period he also wrote critical essays on Mirabeau, Voltaire, and a number of articles for the *Revue de Paris*. In 1841, after having been four times previously rejected, he was elected a member of the French Academy; made shortly afterward a tour in the Rhineland, of which he wrote a brilliant and interesting account in ‘Le Rhin’ (1842). In 1845 he was made a peer of France by Louis Philippe. The Revolution of 1848 threw Hugo into the thick of the political struggle. At first his votes were decidedly Conservative, but afterward whether from suspicion of Napoleon's designs or from other reasons, he became one of the chiefs of the Democratic party. After the *coup d'état*, 2 Dec. 1851, he was one of those who kept up the struggle in the streets against Napoleon to the last. He then fled to Brussels, where he published the first of his bitter satires on the founder of the Second Empire, ‘Napoléon le Petit.’ In August 1852 he went to live in Jersey, but finally settled in Guernsey, where he bought an estate called Hauteville House. In the following year (1853) the famous volume ‘Les Châtiments,’ a wonderful mixture of satirical invective, lyrical passion and pathos, appeared. It was in the comparative solitude and quietness of the Channel Islands that he wrote most of the great works of his later years. ‘Les Contemplations’ (1856); ‘La Légende des Siècles,’ 1st series (1859); ‘Chansons des Rues et des Bois’ (1865), and his celebrated series of social novels, ‘Les Misérables’ (1862); ‘Les Travailleurs de la Mer’ (1866) and ‘L'Homme qui Rit’ (1869). In 1870, after the fall of the empire, Victor Hugo returned to Paris, where he spent his remaining years in occasional attendances at the Senate, and in adding to the already long list of his literary works. Among these latest productions may be cited, ‘Quatre-Vingt-Treize’ (1873); ‘L'Art d'être Grand-père’ (1877); ‘L'Histoire d'un Crime’ (1877); ‘Le Pape’ (1878); ‘La Pitié Suprême’ (1879); ‘Religions et Religion’ (1880); ‘Les Quatre Vents de l'Esprit’ (1881); ‘La Légende des Siecles’ (last series, 1883); ‘Torquemada’ (1882). If not the greatest writer that France has produced, certainly he is her greatest poet. But he had grave defects and limitations, the chief being an entire want of humor, a too frequent straining after effect through the abnormal and bizarre, an overweening belief in his own infallibility and an ever-present conviction that he was a sage, all of whose sayings might be regarded as priceless teachings, to be eagerly caught up by a listening world. His death was the occasion of an imposing public funeral in the Pantheon, preceded by his body lying in state and guarded for several days under the Arc de Triomphe. Posthumous works include ‘Le Théâtre en liberte’; ‘La finde Satan’; and ‘Tonte la lyre.’ An edition of his complete works in 40 volumes appeared at Paris in 1886. The house in which Victor Hugo lived, on the Place des Vosges was transferred to the city of Paris, and now forms a Victor Hugo Museum, full of interesting relics of the poet. (See HERNANI; LES CHÂTIMENTS; MISERABLES, LES; NOTRE DAME DE PARIS; RUY BLAS). Consult Swinburne, ‘Study of Victor Hugo’ (1886); Barbou, ‘Victor Hugo et son Temps’ (1882); Mabilleau, ‘Victor Hugo’ (1893); Nichol, ‘Victor Hugo, a Sketch of his Life and Work’ (1894); Dupuy, ‘Victor Hugo, l'Homme et le Poète’ (1887); Bire, ‘Victor Hugo après 1852’ (1894); Stapfer, ‘Victor Hugo et la grande poésie lyrique en France’ (1901); Claretie, ‘Victor Hugo, souvenirs intimes’ (1902); Mack, ‘Romance of Victor Hugo and Juliette Drouet’ (1905).

HUGO, Okla., city and county-seat of Choctaw County, 125 miles northeast of Dallas, Tex., served by the Saint Louis and San Francisco Railroad. Situated on the Kiamichi River, Hugo is a manufacturing city. The chief industries are in railroad repair shops; manufacture of cotton and its by-products; saw and planing mills, and creosote factories. The government is under a mayor and alderman. The municipality owns the waterworks. Pop. about 4,700.

HUGO OF SAINT VICTOR, a monk of the 12th century: b. either Saxony or Flanders, about 1097; d. Saint Victor's at Paris, probably on 11 Feb. 1141. He was doubtless of Saxon origin, and impelled by a desire for learning, came to France with his uncle, Archdeacon Hugo of Halberstadt. He entered the monastery of Saint Victor at Paris, and rose eventually to be the head of the school there. His contemporaries held Hugo in high esteem for his brilliance as a scholar and teacher, and his erudite writings. These include several mystical treatises; an encyclopedic survey of the field of knowledge: ‘Eruditio didascalica’; and his distinguished work on theology, ‘De sacramentis christianæ fidei,’ in which he opposes the scepticism of other critics and insists on adherence to the best dogma of the Church. The subjective mysticism of his point of view accounts in some degree for his decline in popularity with later scholastics. However, his influence on the 12th century religious thought surpassed that of any other contemporary theologian. His works were first published at Paris (1518), and were reprinted several times.

HUGO VAN DER GOES, hu'go van der goos, Dutch painter: b. Goes, Zealand, date uncertain; d. 1482. Very little is known concerning the early period of his life. It is probable that his artistic education was obtained in Holland. He resided at Ghent and in 1467 was admitted to the painters' guild of that city. He was employed by the city authorities in public decoration in 1468–69 and in 1473–75 was dean of the painters' guild there. Subsequently he retired to a monastery near Brussels, where he remained until his death. There survive copies of an oil decoration by Hugo for the home of a wealthy citizen of Ghent. The Novak Gallery of Prague has the best copy. His greatest surviving work, however, is the Portinari altarpiece, now in the Uffizi Gallery. It represents the Madonna and Child with shepherds, angels, etc. Other works of Hugo are panels in the Vienna Gallery, of which one represents the 'Fall of Man'; in others are 'The Sorrows of Christ' and 'Saint Genevieve.' In the townhall of Bruges is Hugo's 'Death of the Virgin.' Consult Voll, 'Die altniederländische Malerei' (Leipzig 1906); and Wanters, 'Hugues van der Goes' (Brussels 1872).

HUGUENOT (hū'gĕ-nō) **SOCIETY OF AMERICA, The,** a patriotic society, founded in New York city 1883, for the purpose of perpetuating Huguenot history by collecting relevant documents and libraries; and also by public commemoration. The membership is limited to descendants of Huguenot families which emigrated from France prior to the Edict of Toleration (1787); and also to historians and authors who have done important work in Huguenot history. The society has headquarters at New York and branches in other States of the East. Its publications are under the title 'Collections of the Huguenot Society of America.' A celebration of the tercentenary of the Edict of Nantes was held in 1898; an account of the exercises appearing in a memorial volume in 1900.

HUGUENOTS, hū'gē-nŏts, a term of unknown origin, believed to be a diminutive of the personal name Hugo, applied to the Protestants of France during the religious struggles of the 16th and 17th centuries. During the early part of the 16th century the doctrine of Calvin, notwithstanding the opposition of Francis I, spread widely in France. Under his successor Henry II, 1547–59, the Protestant party grew strong, and under Francis II became a political force headed by the Bourbon family, especially the King of Navarre and the Prince of Condé. At the head of the Catholic party stood the Guises. The contest between the two parties was as much political as religious. The result was that a Huguenot conspiracy headed by Prince Louis of Condé was formed for the purpose of compelling the king to dismiss the Guises and accept the Prince of Condé as regent of the realm. But the plot was betrayed, and many of the Huguenots were executed or imprisoned. In 1560 Francis died, and during the minority of the next king, Charles IX, it was the policy of the queen mother, Catherine de Medici, to encourage the Protestants in the free exercise of their religion in order to curb the Guises. In 1562 an accidental conflict between the followers of the Duke of Guise and some Protestants at a church meeting precipitated a series of religious wars which desolated France almost to the end of the century. Catherine, however, began to fear that Protestantism might become a permanent power in the country, and suddenly making an alliance with the Guises, with their help she projected and carried out the massacre of Saint Bartholomew's (q.v.), 24 Aug. 1572. The Protestants fled to their fortified towns and carried on a war with varying success. On the death of Charles IX, Henry III, a feeble sovereign, found himself compelled to unite with the King of Navarre, head of the house of Bourbon and heir-apparent of the French Crown, against the ambitious Guises, who openly aimed at the throne, and had excited the people against him to such a degree that he was on the point of losing the crown. After the assassination of Henry III the King of Navarre was obliged to maintain a severe struggle for the vacant throne; and not until he had, by the advice of Sully, embraced the Catholic religion (1593), did he enjoy quiet possession of the kingdom as Henry IV. Five years afterward he secured to the Huguenots their civil rights by the Edict of Nantes (q.v.) which confirmed to them the free exercise of their religion, and gave them equal claims with the Catholics to all offices and dignities. They were also left in possession of the fortresses which had been ceded to them for their security. This edict afforded them the means of forming a kind of republic within the kingdom, which Richelieu, who regarded it as a serious obstacle to the growth of the royal power, resolved to crush. The war raged from 1624 to 1629, when Rochelle, after an obstinate defense, fell before the royal troops; the Huguenots had to surrender all their strongholds, although they were still allowed freedom of conscience under the ministers of Richelieu and Mazarin. But under Louis XIV a new persecution of the Protestants commenced. They were deprived of their civil rights, and bodies of dragoons were sent into the southern provinces to compel the Protestant inhabitants to abjure their faith. The Edict of Nantes was revoked in 1685, and by this act about 50,000 Protestant subjects were driven out of France to other countries. (See HUGUENOTS IN AMERICA). In the reign of Louis XV a new edict was issued repressive of Protestantism, but so many voices were raised in favor of toleration that it had to be revoked. The Code Napoléon and later enactments place Protestants in France on an equality with their Catholic compatriots. Consult Browning, 'History of the Huguenots' (1840); Félice, 'Histoire des Protestants de France' (1874); Baird, 'The Huguenots' (New York); Thompson, 'The Wars of Religion in France' (1909).

HUGUENOTS, The, a dramatic opera in five acts by Giacomo Meyerbeer, libretto by Augustin Scribe and Deschamps. This is regarded as the best of Meyerbeer's operatic compositions, the music being intensely dramatic, with brilliant orchestration and fine themes. The subject is the persecution of the Protestants by the Catholics in France in 1572. The opening scene represents the interior of the castle of the Count of Nevers, where the Catholic noblemen receive Raoul de Nangis, a Huguenot, recently promoted captain. During the toasts at the banquet each member of the party is called on to give the name of his lady love, when Raoul informs the company that he once rescued a beautiful girl who in her sedan chair was molested by students. She had thanked him for his gallantry and, though he did not know her name, he had lost his heart to her. Marcel, an old retainer of Raoul and a Protestant, warns his master of the danger he is courting by drinking with the noblemen. A lady is announced, and Raoul recognizes her as his unknown charmer. She turns out to be Valentine, daughter of St. Bris, betrothed to the Count of Nevers. She has come to beg the Count to release her from her promise, to which he reluctantly agrees. A page brings a note to Raoul, in which he is commanded to attend a lady, unknown to him. The others, however, recognize the seal of Queen Margaret of Valois; regarding Raoul as an important person, they endeavor to win his friendship. The second act shows Raoul in the presence of the Queen, who is striving to reconcile the warring religious factions. With this object she desires Raoul the Protestant to marry Valentine, her maid of honor and a Catholic. The girl had told her mistress of her meeting with the dashing cavalier and of her love for him. Raoul, as yet not knowing that he is speaking to the Queen, willingly vows to be Margaret's knight and promises St. Bris to wed his daughter. When, however, he finds that that daughter is his unknown lady, about whom he entertained certain doubts, he revokes his promise and makes an enemy of the offended father. On behalf of Raoul, Marcel later carries a challenge to St. Bris, who accepts it, but a fanatical noble named Maurevert advises St. Bris to crush his enemy by other means. Notwithstanding her disappointment with Raoul, Valentine determines to save him and tells Marcel to warn his master not to meet his opponent alone. In the presence of four witnesses the duel takes place, during which a quarrel breaks out between Catholic and Protestant citizens. The Queen intervenes and listens to the mutual recriminations, not knowing which side to believe, when Valentine enters to bear witness. Raoul now learns the object of her interview with Nevers — to regain her freedom. But too late, for her father has again promised her to Nevers, who arrives on the scene accompanied by wedding guests. In the fourth and fifth acts the dreadful Saint Bartholomew's night is shown. Raoul takes a last farewell of Valentine in her room when her father breaks in with a party of Catholics. Raoul hides and hears the details of the great conspiracy to destroy the Protestants, to begin with the murder of their leader, the great Coligny. While all the assembled Catholics agree to the plot, Nevers alone declines to soil his honor by murder, but is willing to fight in honest battle. Raoul resolves to warn his brethren; despite Valentine's entreaties he rushes forth. At the end the Queen and her husband, Henry of Navarre, are seated in the hall surrounded by courtiers when Raoul rushes in pale and blood-stained, describes the horrors being perpetrated outside and implores the royal help. It is too late. Valentine and Raoul meet again; she implores him to accept her faith and thus save his life. He remains firm, however; nothing can move him. Then Valentine decides to remain. She accepts his creed and they meet death together.

HUGUENOTS IN AMERICA. The French Protestant settlements in the New World divide themselves into two classes: those of choice (or at least with time and opportunity to make choice) and those of necessity. The former extend from the middle of the 16th century down to the capture of New York by the English in 1664; the latter comprise all those dating from the increasing severity of repression that heralded the Dragonnades and the Revocation of the Edict of Nantes to the end. The former were deliberately organized colonizations, of the same stamp as the English and from the same motives; the latter were the desperate and generally hurried resource of crowds of ruined exiles. The former were complete failures, and were soon suppressed, absorbed or exterminated; the latter sought only life and livelihood and welcomed absorption. The former include the abortive attempts in Brazil and Florida, the earliest settlements in Acadia and Canada, the first settlement of New York and the settlement of some of the West Indies; the latter include the feeble attempts at settlements in New England, the flood of accessions to the French element in New York, the founding of New Rochelle, the migrations to Pennsylvania, Delaware and Maryland, the promising but aborted attempt in Virginia and, greatest of all, the tide of immigrants that created South Carolina.

The first attempt at creating a New-World Huguenot asylum and magazine of supplies was undertaken in 1555; Nicholas Durand de Villegagnon pretended to undertake it for Coligny, and settled a colony in Rio Janeiro Harbor. But it was half Catholics; Villegagnon was a scamp, persecuted and scattered the Protestants and finally deserted the colony; and the Portuguese killed the remnant in 1567. A more honest attempt was made by Jean de Ribault in 1562, at Port Royal, S. C., but failed. In 1564 René de Laudonnière founded a colony on the Saint John's in Florida, at Fort Caroline; but the next year Pedro Menendez de Avillés butchered the entire settlement. Saint Bartholomew and the religious wars intervened; and no further efforts were made till after the accession of Henry of Navarre, who had imbibed the ardor for colonization from Coligny. In 1664, under his commission, Sieur de Monts planted a settlement to be on the basis of perfect religious equality, the first in the New World — at Port Royal, N. S.; French mercantile jealousy had the commission revoked and it perished; but two years later it was refounded by Poutrincourt, and De Monts and Champlain founded Quebec. In 1613 Sir Samuel Argall (q.v.) destroyed Port Royal, but the French stayed and bands of Protestants came to reinforce them at intervals. A small settlement was made on Newfoundland, but was broken up by the government except for a few who would turn Catholics. The founding of New Amsterdam, usually supposed to be by the Dutch, was in fact by Huguenots under Dutch auspices. The Huguenots — largely French-speaking Walloons — who had crowded into the Netherlands to escape persecutions, had tried to gain permission to found settlements in the English colonies; rebuffed in this, they engaged with the Dutch, and the first shipload of emigrants that came to the future New York were entirely Huguenot, Peter Minuit himself being a Walloon. French families had been there already for years, the first white child born on Manhattan Island being French. For three generations the French element continued to be a highly important factor in the city, and composed much of the business aristocracy; even after the English occupation, all official documents were printed in both Dutch and French as well as English. Of the first shipload of emigrants, a number went up the Hudson and founded Fort Orange (Albany). In 1660 a number of Walloon and Vaudois exiles, who had taken refuge in the Lower Palatinate, settled near Kingston, N. Y.; later, the Vaudois founded New Paltz in the Wallkill Valley. In 1677 a French town was founded at Hackensack, but the fast increasing Dutch soon swamped it. Small French groups settled in various parts of New Jersey.

Of the second class, the refugee emigration — 100 scattered and hurried in general to found separate French settlements — the first beginning from the north was at Boston. From 1660 on, small numbers had come from the Channel Islands and Rochelle, but after the Dragonnades 200 or 300 families came over, including some of the most notable names in Boston history. A settlement at Oxford, Mass., was made in 1687, primarily to convert the Nipmuck Indians, but that tribe joined hands with the Canadian tribes in league with the French and inflicted such horrors on them — one whole summer besieging them in their blockhouse — that the settlement broke up in despair, many of them taking refuge in Milford, Conn. Many small groups settled in Rhode Island; the largest had a miserable history, being defrauded by a New England company organized expressly to sell to innocent foreigners a tract of land to which it had no title. In Connecticut, Hartford and Milford received the greatest number. In New York the arrivals strengthened the French element, but soon melted into the general mass. In Pennsylvania. Delaware and Maryland, many hundreds settled, but as scattered members of the population, and left no outward trace. In Virginia, whose southern climate was congenial to them, the Huguenots had settled in considerable numbers for many years, but in 1690 William III sent over some 300 Huguenots who had followed him from Holland and they made a settlement named Monacantown, from an extinct Indian tribe. In 1700, after long negotiations, four shiploads more came over under Marquis de La Muce; about half of them settled at Jamestown, Va., and in South and North Carolina, the rest at Monacantown. Several hundred more came over at different times and the settlement seemed to have struck enduring roots; but furious religious dissensions broke it in two, and the pastor led part of them to the Trent in North Carolina, whence in fear of Indian massacre they finally went to South Carolina, the Canaan of the Huguenots, settling at Jamestown. This South Carolina French immigration, due to the latitude and soil fitting their habits, began in 1670 in small numbers. In 1680 the city of Charleston was founded, largely under French auspices; the same year Charles II sent over about 90 Huguenots to produce wine, oil and silk. After the Revocation the great tide began to flow in; in 1687 there were four wholly or largely French settlements — Jamestown on the Santee, the «Orange Quarter» on the Cooper, Saint John's Berkeley and Charleston. In 1732 a band of 360 French-Swiss Protestants settled Purysburg on the Savannah; and in 1764 the last French colony was founded — New Bordeaux in Abbeville County. In the intervals there was a steady stream, very large for many years after 1685. Some of the greatest names in Southern history are French, and the entire character and action of the State have been deeply molded by this fiery, impulsive, gallant strain. It is pitiful to record that after all the sacrifice and courage of these exiles, religious persecution forced them to close their churches. All but members of the Church of England were disfranchised in 1706, and the Huguenots were bribed into submission by government support of the churches and having the liturgy translated into French.

The Huguenot settlements in the West Indies — Saint Christopher, Martinique, Guadeloupe and some smaller ones — belong in origin to the former group, that of voluntary colonization; their later history and the flight from them belong to the latter. They were colonized by a trading company under Richelieu's patronage from 1626 on; there was nominal prohibition of public worship, but actually the law was a dead letter, as there would have been no trade but for the Huguenots; the Walloon Synod of Holland supplied ministers and the life was one of prosperity and content. Then as the Revocation approached, atrocious penal laws were passed, but still not enforced. The Revocation changed everything into a scene of misery. The first result was the using of the islands as a penal settlement for the Huguenots of France; they were sold into service, sometimes of the worst character, and the horrors of the passage rivaled the worst of the slave-trade. Then the governor-general was ordered to extirpate heresy at all hazard and threatened a dragonnade if the inhabitants did not recant. The effect was a general flight; next a stern order from the governor-general to stop or he would carry out the government orders in all their severity, which produced a still greater stampede, assisted by the Catholics themselves. In a few months the islands were half depopulated and their trade nearly ruined. The king then modified his orders; the flight ceased and a few returned; but most of the refugees remained in the English colonies or Bermuda. Several score at least removed to New York, and some of them founded New Rochelle; a few to New England, and the Southern colonies naturally received the largest quota. This immigration had an important effect on the United States trade with the West Indies, as the Huguenot merchants, from their familiarity with the region and their family ties, took the lead and greatly developed it.

The «dead-line» of the French churches in America, the test of that element's separate existence, is about the middle of the 18th century; beyond that, according to Baird, few existed and fewer kept their language. French instinct was to blend, and of course it was much the best that it should do so. The element was absorbed soon and utterly. but its blood and its ideas have been very valuable to the United States. Consult Baird, 'History of the Huguenot Emigration to America' (1885); 'Collections of the Huguenot Society of America.'

HUIA, a New Zealand bird (*Heteralocha acutirostris*), one of the starling family. It is about the size of a thrush, is greenish black in color, with a white tail band and red wattles at the gape. The bill of the male is much shorter than that of the female, the latter being long and curved like that of a snipe. It feeds on timber beetles. The bird is fast becoming extinct, being sought after as a cage-bird by the whites and by the natives for its tail feathers. It is now protected by law in an effort to save it.

HUICHOL (wē'chōl) **INDIANS.** See INDIANS, AMERICAN.

HUILA, wē'lạ, Colombia, a department situated between the central and western Cordilleras. The principal river is the Magdalena, which traverses it in a northward direction. Cacao, rice, coffee, sugar-cane, tobacco and corn are cultivated. There is also some stock raising and gold mining; and manufactures of straw hats, cigarettes and woolens are carried on. The capital is Neiva. The country on the whole is not developed. Pop. about 160,000.

HULL, Charles Henry, American historian and political scientist: b. Ithaca, N. Y., 29 Sept. 1864. He received his education at Cornell University and subsequently spent several years in Germany at Göttingen, Berlin and Halle, where he took his Ph.D. in 1892. He became assistant librarian at Cornell (1886–90), and then held an instructorship in political science there (1892–93). He was appointed professor of American history in 1901, which office he has since occupied, combining with his professorial duties from 1908–13, the office of dean of the College of Arts and Sciences. He has published 'The Economic Writings of Sir William Petty.'

HULL, Cordell, American congressman: b. Overton County (now Pickett), Tenn., 2 Oct. 1871. He studied law at Lebanon Law School where he was graduated in 1891. From 1893–97, he was a member of the Tennessee house of representatives; judge of the 5th judicial circuit of Tennessee 1903–07; and was elected a member of the 60th and 65th United States Congresses (1907–19). He rendered distinguished service in the Spanish-American War as captain of the 4th Tennessee regiment.

HULL, Edward, Irish geologist: b. Antrim, 21 May 1829. As a member of the Geological Survey of Great Britain for 20 years, he geologically mapped a large portion of the central counties of England. From 1869–90 he was professor of geology at the Royal College of Science, Dublin; and in 1883 commanded an expedition under the auspices of the Palestine Exploration Society to Arabia Petræa and Palestine. Among his important works are 'The Coal-Fields of Great Britain' (1865); 'Building and Ornamental Stones' (1872); 'A Text-Book of Physiography' (1888); 'Mount Seir, Sinai and Southern Palestine' (1885); 'Volcanoes, Past and Present' (1892); 'Our Coal Resources at the Close of the 19th Century' (1897); 'Reminiscences of a Strenuous Life' (1910); 'Monograph on the Sub-oceanic Physiography of the North Atlantic Ocean' (1912).

HULL, Isaac, American commodore: b. Derby, Conn., 9 March 1773; d. Philadelphia, 13 Feb. 1843. He commenced his career in the merchant service, and was commissioned as lieutenant in the navy at the commencement of hostilities with France in 1798. In 1800, when first lieutenant of the *Constitution,* he cut out a French privateer from under a strong battery in the harbor of Port Plate, San Domingo. During the war with Tripoli (1802–05) Hull served with distinction in the squadrons of Commodores Preble and Barron, in command of the schooner *Nautilus* and brig *Argus,* participating in the several attacks on the city of Tripoli in July, August and September 1804, and subsequently co-operating with General Eaton in the capture of the city of Derne. In May 1804 he was promoted to the rank of master commandant, and in April 1806 to that of captain. At the opening of the War of 1812 between the United States and Great Britain he was in command of the frigate *Constitution,* and in July of that year, while cruising off New York, fell in with a British squadron, which chased the *Constitution* closely for nearly three days and nights. The wind was light and baffling, but Hull handled his vessel with superior seamanship and finally escaped without injury; at one time he resorted to a novel and successful expedient; the boats were lowered, and all the spare rope on board was bent to a kedge anchor which was carried out nearly a mile ahead and let go. The ship was warped up to this kedge, which was weighed while another was carried out. In this way she left her pursuers before they discovered the manner in which it was done. After this remarkable escape, Hull went into Boston for a few days, whence he sailed 3 August, and 19 August met the English frigate *Guerrière,* which after a short conflict he reduced to a complete wreck and forced the English to surrender. (See CONSTITUTION, THE). As this was the first naval action of the war, it was regarded as a very important one; Captain Hull was enthusiastically received, and Congress at its next session presented him with a gold medal. After the war his principal services were in command of the navy yards at Boston and Washington, of the squadrons in the Pacific and Mediterranean, and as a member of the board of navy commissioners.

HULL, William, American soldier: b. Derby, Conn., 24 June 1753; d. Newton, Mass., 29 Nov. 1825. He was graduated at Yale College in 1772, then taught school and studied theology for one year, but finally studied law at Litchfield, Conn., and was admitted to the bar in 1775. He entered the army of the Revolution at Cambridge in 1775 as captain of a Connecticut company of volunteers; was promoted to the rank of major in the 8th Massachusetts regiment in 1777, and to that of lieutenant-colonel in 1779. He was in the battles at White Plains, Trenton, Princeton, Stillwater, Saratoga, Monmouth and Stony Point and in all the battles fought against Burgoyne. His services throughout the war received the approbation of his superior officers, and neither his courage nor patriotism was ever doubted. After the English evacuation he accompanied Washington to New York and was made lieutenant-colonel of the one regiment which then made up the entire peace establishment of the United States army. He was sent to Canada as a commissioner in 1784, and again in 1793, after which he returned to the practice of law at Newton, Mass. After a trip to Europe in 1798 he was appointed judge of the Court of Common Pleas and later was elected to the Massachusetts senate where he served until 1805. In 1798 he was also made major-general of the Massachusetts militia. He was governor of Michigan Territory from 1805 till 1812, when he was appointed as brigadier-general to the command of the northwestern army. He marched his troops to Detroit, heard of the declaration of war, and of the fall of Michilimackinac, which let loose the Indians of the Northwest upon him, crossed into Canada, but found his communications cut off, recrossed, and on the arrival of General Brock surrendered to that officer the post of Detroit and the territory. For this he was tried two years after by a court-martial, and sentenced to be shot. The execution of the sentence was remitted by the President in consideration of his age and Revolutionary services. Historians are now agreed that the difficulties which surrounded General Hull were so great that we need not ascribe his surrender either to treason or to cowardice. He published ‘Defence of Brigadier-General W. Hull, etc.’ (Boston 1814); ‘Memoirs of the Campaign of the North Western Army of the United States, 1812’ (Boston 1824). Consult Campbell, M., ‘Revolutionary Services and Civil Life of General W. Hull’ (New York 1848); Clarke, J. F., ‘History of the Campaign of 1812’ (New York 1848); Clarke, S. C., ‘General W. Hull's Surrender at Detroit, 1812’ (in *Magazine of American History*, Vol. XXVII, p. 343, New York 1892); id., ‘General W. Hull’ (in *New England Historical and Genealogical Register*, Vol. XLVII, pp. 141 and 305, Boston 1893); Forbes, J. G., ed., ‘Report of the Trial of Brid.-Gen. W. Hull, etc,’ (New York 1814); Foster, J., ‘The capitulation, or a History of the Expedition Conducted by William Hull’ (Chillicothe 1812); Lossing, B. J., ‘Hull's Surrender of Detroit’ (Philadelphia 1875); Summer, W H., ‘General W. Hull’ (in *New England Historical and Genealogical Register*, Vol. IX, p. 41; Vol. XI, p. 167; Boston 1855 and 1857); Snelling, J., ‘Remarks on Hull's Memoirs of the Campaign of 1812’ (Detroit 1825).

HULL, Canada, town and county-seat of Ottawa County, Quebec, on the Ottawa River, at the junction of the Gatineau River, opposite the city of Ottawa, and on the Canadian Pacific Railway. It is connected with its important neighbor by a fine suspension bridge spanning the Chaudière Falls. Iron mining is carried on in the neighborhood, and the falls afford immense water power. Lumbering is the chief industry of the district; and Hull has vast lumber yards, saw- and planing-mills, and manufactories of pulp, paper, matches, pails, woodenware, woolens, axes, etc. The total annual value of its manufactures is over $7,258,000. It has several churches, a college, a convent, many fine residences, and French and English newspapers. The population is chiefly French Canadian. The town has been rebuilt since its almost total destruction by fire, 26 April 1900. Pop. 18,222.

HULL, officially **KINGSTON-UPON-HULL,** England, a city, river port, municipal and parliamentary borough, and self-contained county, situated in the East Riding of York, on the north shore of the estuary of the Humber, where it is joined by the Hull, 34 miles east-southeast of York. Its total area in land and water is 9,042 acres. The buildings of note are the town-hall, the exchange, the corn exchange, market-hall, postoffice, the custom-house, Trinity House, dock offices, public rooms, royal institution (containing the rooms of the Philosophical Society, etc.), art gallery, technical schools, central library, Hymers College, grammar-school, the jail, royal infirmary, borough asylum, hospitals, crematorium and dispensary. The city possesses three well-laid-out public parks. The industries are varied. There are several ship-building yards, iron-foundries, machine-shops and steam flour-mills; the other principal branches of industry include seed-crushing, color-making, paper-making, canvas, rope and cable-making, tobacco manufacturing and oil boiling. Hull ranks as the sixth port in the kingdom, and has extensive ship accommodation, docks, quays, etc. The principal exports are coal, coke and manufactured fuel (in 1914, 3,056,368 tons valued at $10,133,265), machinery, metal goods and woolen and cotton goods; imports — timber, corn, iron, wool, flax, hemp, tallow, hides, pitch, tar, resin, bones, etc. The total net tonnage of ocean-going vessels entering and leaving the port in 1914 was 6,760,000. The name of Kingston-upon-Hull was given by Edward I, who erected a fortress, and constituted it a chartered town and port. When Edward III invaded France in 1359 Hull contributed 16 ships and 470 mariners. During the Civil War Hull was besieged unsuccessfully by the Royalists twice. Pop. 277,991 of which 136,006 are males.

HULL HOUSE. See SOCIAL AND UNIVERSITY SETTLEMENTS.

HULLAH, John Pyke, English musical composer: b. Worcester, 27 June 1812; d. London, 21 Feb. 1884. In 1833 he entered the Royal Academy of Music. His first important composition, an opera entitled ‘The Village Coquettes,’ of which the words were by Charles Dickens, was successfully produced at Saint James' Theatre in 1836. Early in 1841 he opened classes in Exeter Hall for the instruction in vocal music of schoolmasters and the general public, and from 1849 to 1860 continued them in Saint Martin's Hall, built for him by his friends and supporters. His classes were remarkably successful despite much adverse criticism of his method of teaching. In 1858 he succeeded Horsley as organist at the Charterhouse, and in 1872 received the appointment of musical inspector of training schools for the United Kingdom. He conducted the Philharmonic concerts at Edinburgh 1866–67, and those of the Royal Academy of Music 1870–73. He also held professorships in King's College, Queen's College and Bedford College. Hullah's best-known compositions are songs, of which several, such as ‘The Sands of Dee,’ ‘Three Fishers,’ ‘The Storm,’ and ‘O that We Two Were Maying,’ have become very popular. He issued many excellent collections of songs and other musical pieces, among which are ‘Part Music,’ in three series (1842–45); ‘Vocal Scores’ (1846 onward); ‘School Songs’ (1851); ‘Sea Songs’; ‘Singer's Library of Concerted Music’ (1859); and ‘Song Book’ (1866). Dr. Hullah was the author of the following among other works on the history and theory of music: ‘Grammar of Vocal Music’ (1843); ‘On Vocal Music’ (1849); ‘Grammar of Musical Harmony’ (1852); ‘The History of Modern Music’ (1862); ‘Grammar of Counterpoint’ (1864); ‘Music in the House’ (1877). Consult the ‘Life’ by his wife (1886).

HULLIN, u'lăṅ', **Pierre Augustin,** French general: b. Geneva, 1758; d. 1841. He learned the trade of watchmaking and went to Paris to practise. When the Revolution broke out, Hullin was one of the leaders of the attack on the Bastile. However, he was unwilling to go to the extremes to which his fellow revolutionists reverted during the Terror, and was consequently imprisoned by them. When released, he joined the Italian army and was made adjutant-general to Napoleon I. In 1802 he was given command of a division and two years later was head of the military court which pronounced judgment on the Duke d'Enghien (1804). Napoleon held him in high esteem, distinguishing him with the rank of count in 1809. In 1812 he was made governor of Paris. When the power of Napoleon declined, Hullin made several unsuccessful efforts to maintain his position, and although he was restored to the governorship of Paris during the Hundred Days (q.v.), he was later banished. After a few years at Brussels and Hamburg, he returned to France in 1819.

HUMACAO, oo'ma-kä'o, Porto Rico, city and capital of the province of the same name, on the Humacao River, about five miles from the coast. It is beautifully situated in a mountainous district. The chief public buildings are the schools and library. The original settlement at Humacao was made in 1793, and it became incorporated as a city in 1894. Pop. 6,500.

HUMAITA, oo-mä-ē'tä, Paraguay, town and fort, on the Paraguay River, near the mouth of the Paraná River, in the southwestern part of the republic. A situation of strategic importance during the war of the "Triple Alliance," it withstood a siege for a whole year, the attacking forces being Argentine and Brazil soldiers. In 1868 it surrendered and the fortifications were destroyed. It is surrounded by a fertile agricultural country. There is but little local manufacturing, but there is an extensive trade in coffee, sugar, cotton, tobacco, hides and live stock. Pop. 4,000.

HUMAN EMBRYOLOGY. See EMBRYOLOGY, HUMAN.

HUMANE ASSOCIATION, American, a consolidation of various societies, formed at Cleveland, Ohio, in 1877, becoming a national organization for the prevention of cruelty to animals and children. The initial work of the Society was to regulate the abuses in cattle-transportation by the railroads, and to secure the passage of State laws looking to this end. It offered a prize of $5,000 for the best model of a cattle car that would make possible the feeding, watering and resting of cattle in transit, and many improved cattle cars were brought into use. Prizes for essays on vivisection, its abuses and their remedy were also offered for competition in 1900 among colleges and medical students. Since 1913 the societies represented in the Association number over 300 with an aggregate membership of 141,000, and since that year have published the *National Humane Review*.

HUMANE SOCIETY, Royal, formed in London, in 1774, for the purpose of resuscitating those who had been immersed in water and were apparently drowned. The headquarters is on the Serpentine in Hyde Park and numerous stations are maintained in different parts of the metropolitan area. At the present time it distributes rewards, consisting of medals, clasps, testimonials and sums of money to those who save or attempt to save life from drowning. Also "all cases of exceptional bravery in rescuing or attempting to rescue persons from asphyxia in mines, wells, blast-furnaces, or in sewers where foul gas may endanger life, are recognizable by the society." It likewise gives prizes for swimming to the pupils of public schools and of training-ships.

HUMANISM. (1) That phase of the Renaissance which consisted in a renewed study of the so-called humanities — the Latin and Greek classics. Like the entire movement of the Renaissance, Humanism had its source in Italy, which had at all times maintained a continuous (through often a slender) tradition of its ancient greatness. Furthermore, Italy was the nearest of the civilized western countries to the Empire of the East, and so it was to Italy that the Byzantine scholars fled when their country fell under Turkish dominion. Much before this, however, the Italian scholars had begun to set a high price on the remains of ancient learning. Petrarch (1304–74), and Boccaccio (1313–75) (qq.v.) were both more highly esteemed by their contemporaries for their Latin writings than for their compositions in the vernacular, and both spent much effort in the discovery and preservation of classical works. Boccaccio indeed was familiar with Greek as well as with Latin.

The definitive introduction of Greek into Italy, however, took place in 1391, when Michael Chrysoloras, being on his way through Florence on a mission from the emperor of Byzantium, was induced to settle there and teach Greek. After him came Johannes Bessarion, Theodorus Gaza, Johannes Argyropoulus and Demetrius Chalcondylas, who had left the Byzantine Empire on account of the menace of the Turks or on account of the fall of Constantinople in 1453. These men had as pupils Piero and Lorenzo de Medici, Pitian, Reuchlin, Linacre, Grocyn, Latimer and many other scholars from both sides of the Alps. The recovery of manuscripts became the passion of monarchs and popes. Nicolas V, Leo X, Cosimo and Lorenzo de Medici, Alphonso the Magnanimous of Naples, Guarino Veronese and Poggio Bracciolini stand out among the many ardent bibliophiles of this age. Under the de Medicis the revival of learning came to be associated with a revival of Platonism and a new academy was organized, the most distinguished head of which, Marsilio Ficino (1433–99), tried to unite Platonism and Christianity. Aristotle too was read in the original, and many disputes arose between the advocates of the Catholic or Arabic traditions and those who interpreted the works of Aristotle in their own fashion.

Humanism received a great impetus from the invention of printing. Aldus Manutius (q.v.; 1450–1515), the greatest of Italian printers, produced editions of 28 Greek and Latin classics. Aldus associated himself with a large number of scholars, who co-operated with him in his work. For him publishing was not merely a business, but a propaganda for the dispersion of knowledge.

The revival of learning ended in Italy with the conquest of the Italian cities by the ruffianly soldiers of Charles V in 1527–30, after the strength of the country had been sapped by the dissipation and profligacy which followed the upsetting of the old religious sanctions by the influence of ancient philosophy. This failed to impose its own standards of righteousness on a people given over to the splendid luxury which accompanied the rebirth of art. Humanism might well have perished had it not been that it had already taken root in a more northern soil. Among the pioneers of humanism beyond the Alps were Agricola (1443–85), Johann Reuchlin (1455–1532), and Melanchthon (1497–1560). Between these men and their obscurantist reactionary opponents there was waged a continual strife. Italian humanism turned its energies primarily to literature and art; German humanism to theology, education and social betterment, thus forming the prelude to the Reformation.

Like the humanism of all northern countries, that of France had Italian origin, and may be said to have received its first great impulse from the invasion of Naples by Charles VIII in 1494. It owed much, however, to the influence of perhaps the greatest of all the scholars of the Renaissance, the Dutchman Desiderius Erasmus (1467–1536). Erasmus also played an important part in British humanism. Humanism in England was foreshadowed by Chaucer, who was at once a literary debtor and a disciple of Petrarch and Boccaccio. In the reign of Henry V, Humphrey, Duke of Gloucester, was a patron of learning in the Italian sense, and gathered around him a coterie of English and Italian scholars. However, British humanism first became definitely established by Thomas Linacre (1460–1524), William Grocyn (1446–1519), and William Latimer. These three friends made secure the hold which humanism had already obtained on Oxford, so that British humanism became able to meet that of Italy on even terms. Through Colet (1467–1515), the pupil of Linacre and Grocyn, the humanistic movement led to the foundation of the great schools of England. Sir Thomas More (1478–1535), another pupil of Linacre and Grocyn, did much to break down the opposition to Greek at Oxford. More was also an ardent Platonist, as is shown by his famous book, the 'Utopia,' which was patterned after the 'Republic' of Plato. Greek was established at Cambridge through the efforts of Erasmus and John Fisher (1469–1535), bishop of Rochester. The humanism established in England by these men spread throughout society, and paved the way for the great Elizabethian period of literature and culture. See Renaissance for further details and for bibliography.

(2) The word "humanism" is often used for that theory of education which claims that a study of the classics is the best means for a well-rounded and broad culture. It often takes the form of a protest against the scrappiness of a training based on a too exclusive devotion to natural science.

(3) "Humanism" is sometimes used to designate that type of philosophical view which makes man the measure of all things. Its chief contemporary exponent is F. C. S. Schiller of Oxford.

Bibliography.— Consult Jebb, R. C., 'Humanism in Education' (New York 1899); Schiller, F. C. S., 'Humanism' (New York 1903); Mackenzie, J. S., 'Lectures on Humanism' (New York 1907).

HUMANISTS, a class of scholars which arose about the 14th century in Italy and was prominent throughout Europe in the 15th and 16th centuries. See Humanism.

HUMANITARIAN CULT, The, a society founded at New York, 5 Nov. 1914, by Misha Appelbaum. Its object is to develop between individuals a proper sense of responsibility, to create a correct understanding of the essence of true religion and to develop the spirit of helping mankind from a sense of love, rather than merely from a sense of duty. It is absolutely non-sectarian; has no officers, incurs no expenses and levies no dues. Collections and contributions are not permitted. The society is non-partisan in politics but is interested in securing legislation for improving the condition of the masses. The only qualification necessary for membership is a desire to be just human and be of some assistance to one's fellow-man. Its relief work is undertaken voluntarily by the members, who give the unfortunate kindness and sympathy as well as material aid. The society aims to abolish all philanthropic institutions, charity societies and foundations, by the establishment in every municipality of departments of welfare. A section of the cult is devoted to the abolition of capital punishment, and it has done good work in creating public sentiment in favor of abolishing the death penalty in New York State. The movement has spread to other States. Meetings and concerts are held at frequent intervals in Carnegie Hall, New York. Its propaganda is also furthered by the *Humanitarian Magazine* (New York). The cult has now a total membership of 123,012.

HUMANITARIANS, a term applied to the various classes of anti-Trinitarians, who regard Christ as a mere man. The earliest known author of the purely humanitarian theory is Theodotus of Byzantium, who lived in the 2d century. A contemporary of his, Artemon, taught the same doctrine, and asserted that such had been the universal belief of Christians up till the beginning of the 3d century. See Unitarianism.

HUMAYUN, Mogul emperor of Delhi: b. 1508; d. 1556. He was the son of Baber, whom he succeeded in 1530. His reign was occupied with 10 years of warfare in the effort to maintain his possessions; but he was finally driven from India. Taking refuge at the court of Persia, he devoted his energies to plans for his restoration. With his son, the famous Akbar, he returned and reconquered Delhi in 1555. He died shortly afterward and was succeeded by his son. A splendid mausoleum was erected for him at Delhi.

HUMBER, the estuary of the Ouse and Trent rivers between Yorkshire and Lincolnshire. Its length is 38 miles, and its width varies from one to seven miles. It is important as a shipping route, having the city of Hull on its north shore and Great Grimsby on the south. The presence of shoals makes careful buoying necessary. The Humber is connected by canals with South Yorkshire and Trent. Historically, the river is known as the point of entrance for the Norse invasions in the 9th and 10th centuries. The tidal bore sometimes occurs on the Humber and the shore-line is constantly shifting.

HUMBERT I, Ranieri Carlo Emanuele Giovanni Maria Ferdinando Eugenio, king of Italy: b. Turin, 14 March 1844: d. Monza, near Milan, 29 July 1900. He was eldest son of Victor Emmanuel II and Queen Marie Adelaide, daughter of the Archduke Regnier of Austria. He received a most careful education, entered the army, took part as a youth in the war of independence, and in 1866 was in command of a division at Custozza. On 22 April 1868 he married his cousin, Princess Margherita of Savoy, daughter of the Duke of Genoa. On the death of his father he succeeded to the throne of Italy, 9 Jan. 1878, as Humbert I. During his reign he carefully regarded constitutional limitations, and directing his choice of prime ministers according to parliamentary conditions selected but one, Rudini, from the Conservatives. In 1891 was concluded the «Triple Alliance» with Germany and Austria, a compact which necessitated the maintenance of a large army. and navy, and the oppressive taxation of an already burdened country. Humbert believed in colonial expansion, which he inaugurated by the occupation of Massowah, on the Red Sea. The Italian troops suffered reverses in 1887 and 1888, when they were defeated by the Mahdi, and 1 March 1896 when they lost the battle of Adowa to the Abyssinians. Humbert's attitude toward the Vatican was one of firmness, respecting all guarantees to the Pope, but insisting on the permanence of the Italian possession of Rome. His private munificence—it is said that he expended not less than $500,000 yearly in benefactions — and his personal interest and courage in the rescue work after the earthquake at Ischia (28 July 1883), and in visits to Busca and Naples during the cholera epidemic (1884), made him greatly respected by the Italians, to whom he was known as «Humbert the Good.» He was thoroughly a soldier and eager in the interests of the army. Two unsuccessful attempts were made upon his life, one at Naples, 17 Nov. 1878, by Passanante, a fanatic, and another near Rome, 22 April 1897, by Acciarito, an anarchist. On 29 July 1900 he was shot and killed at Monza, near Milan, by the anarchist Bresci. See ITALY — HISTORY.

HUMBERT SWINDLE, The, one of the most daring and extensive frauds on record, perpetrated for 20 years by a Mme. Humbert of Paris with the aid of her husband and various accomplices. It was alleged by Mme. Humbert that a certain Robert Henry Crawford, American millionaire, had left to her his fortune of $20,000,000. A subsequent will divided the estate between her younger sister, Marie Daurignac, and Henry and Robert Crawford, nephews of the testator, while a third document bound the heirs to the preservation of the title deeds and securities, and placed these in the keeping of M. and Mme. Humbert until Marie should attain her majority. Without examination the alleged title deeds and securities were deposited and sealed in a safe by the authorities. On this wholly fictitious basis Mme. Humbert netted about $10,000,000, while the amount of notes in the form of original loans and renewals equaled $140,000,000. The fraud was discovered, and the Humberts disappeared in May 1902; they were arrested in Madrid in December and brought to Paris for trial. They were found guilty of forgery and swindling, and were sentenced 22 Aug. 1903 to five years' solitary imprisonment, but were released 13 Sept. 1906.

HUMBLE-BEE. See BUMBLEBEE.

HUMBOLDT, hŭm'bōlt (Ger. hoom'bōlt), **Friedrich Heinrich Alexander,** BARON VON, German traveler and naturalist: b. Berlin, 14 Sept. 1769; d. there, 6 May 1859. His father was chamberlain to the king of Prussia. He studied at the universities of Frankfort-on-the Oder, Berlin and Göttingen, and in 1790 traveled along the Rhine to Holland, France and England. This journey gave rise to his 'Observations on the Basalt on the Rhine,' published in 1793. In 1791 he studied mining and botany at the mining school in Freiberg, where his acquirements, his attractive and instructive conversation, his wit and goodness of heart gained him universal esteem and affection. In 1792 he was appointed assessor in the mining and smelting department, and soon afterward removed to Bayreuth as overseer of the mines in Franconia. Here he introduced many improvements, among which was the establishment of the mining school at Steben; he likewise made valuable galvanic experiments, the results of which were published in 1796, in two volumes. But in 1797 he gave up this office from a desire to travel. Owing to the disturbed state of the Continent, however, it was not easy for him to carry out his project. For some time he resided in various parts of Germany, particularly at Jena, where he became intimately acquainted with Goethe and Schiller. In 1797 he went, in company with his brother Karl Wilhelm, a Prussian minister of state, to Paris, where he became acquainted with Aimé Bonpland, a pupil of the medical school and botanic garden in Paris. He then went to Madrid, and having obtained permission from the Crown to travel through the Spanish colonies in America, immediately sent for his friend Bonpland, and sailed with him from Corunna. They landed at Teneriffe, where they ascended to the crater in Pico, in order to analyze the atmospheric air, and to make geological observations. In July they arrived at Cumana in South America. For five years they were occupied incessantly in traveling through tracts of the earth rich in all that could interest the scientific observer, and till then never scientifically described. They explored the regions of South America watered by the Orinoco and the upper part of the Rio Negro, fully tracing the connection between the Orinoco and the Amazon; then returned to the coast and sailed for Cuba, where they remained some months. Leaving Cuba in 1801, they returned to the South American continent, sailed up the Magdalena as far as they could, pursued their route by land to Popayan and Quito, and thence as far south as Lima, crossing the Andes no fewer than five times in the course of their journey, and, besides other mountain ascents, climbing Chimborazo (23 June 1802) to an elevation of 19,300 feet, being the highest point of the Andes then reached by man; from Lima they sailed to Guayaquil, and thence to Acapulco, Mexico (January 1803). Some months were spent in examining the City of Mexico and the surrounding country, and in a visit to the United States; and in January 1804, they set sail for Europe, taking Cuba again on their way. On 3 Aug. 1804, they arrived at Bordeaux, bringing with them, as the result of their labors, an immense mass of fresh knowledge in geography, geology, climatology, meteorology, botany, zoology and every branch of natural science, as well as in ethnology and political statistics. Humboldt selected Paris as his residence, no other city offering so many aids to scientific study, or having so many distinguished savants, and remained there till March 1805, arranging his collections and manuscripts, and experimenting with Gay-Lussac, in the laboratory of the polytechnical school, on the chemical elements of the atmosphere. He was accompanied by Gay-Lussac, who exerted a lasting influence on his chemical studies, in a visit to Rome and Naples, and also by Von Buch on his return through Switzerland to Berlin, where, after an absence of nine years, he arrived in November 1805. As the condition of Germany made it impracticable to publish there his large scientific works, he was permitted by King Frederick William III, as one of the eight foreign members of the French Academy of Sciences, to remain in Paris, which was his residence, excepting brief periods of absence, from 1808 to 1827. There appeared his ‘Voyage aux Régions équinoxiales du Nouveau Continent’ (with Atlas, 1809–25; German edition, Stuttgart 1825–32; new edition, edited by Hauff, 4 vols., 1859–60). When in 1810 his elder brother resigned the direction of educational affairs in Prussia to become Ambassador at Vienna, the former post was urged upon Humboldt by Hardenberg; but he declined it, preferring his independence. He had also already decided upon a second scientific expedition, through Upper India, the region of the Himalaya and Tibet, in preparation for which he was diligently learning the Persian language. The political events between the Peace of Paris and the Congress of Aix-la-Chapelle gave him occasion for several excursions. He went to England in the suite of the king of Prussia in 1814; again in company with Arago, when his brother was appointed Ambassador to London; and again in 1818 with Valenciennes from Paris to London, and from London to Aix-la-Chapelle, where the king and Hardenberg wished to have him near them during the Congress. He also accompanied the king to the Congress of Verona, and thence to Rome and Naples; and in 1827, at the solicitation of the monarch, gave up his residence in Paris, and returned by way of London and Hamburg to Berlin, where in the following winter he delivered a series of public lectures on the cosmos. Under the patronage of the Tsar Nicholas he undertook in 1829 an expedition to northern Asia, to explore the Ural and Altai mountains, the Chinese Dsoungaria and the Caspian Sea. In this expedition he was accompanied by Ehrenberg and Gustav Rose. Their course lay through Moscow, Kazan and the ruins of Old Bulghari to Ekaterinburg, the gold mines of the Ural, the platinum mines of Nijni Taghilsk, Bogoslovsk, Verhoturye and Tobolsk, to Barnaul, Schlangenberg and Ustkamengorsk, in the Altai region, and thence to the Chinese frontier. From the snow-covered Altai Mountains the travelers turned toward the southern part of the Ural Range, and traversed the great steppe of Ischim, passed through Petropavlovsk, Omsk, Miask, the salt lake of Ilmen, Zlatousk, Taganay, Orenburg, Uralsk (the principal seat of the Uralian Cossacks), Saratov Dubovka, Tzaritzin and the Moravian settlement of Sarepta, to Astrakhan and the Caspian Sea. They visited the Kalmuck chief Sered Jaab, and returned by Voronesh, Tula and Moscow. The entire journey of over 10,000 miles was made in nine months; its results are given in Rose's ‘Mineralogischgeognostische Reise nach dem Ural, Altai und dem Kasjischen Meere’ (1837–42); and Humboldt's ‘Asie Centrale, Recherches sur les Chaines de Montagnes et la Climatologie comparée.’ It extended the knowledge of telluric magnetism, since in consequence of it the Russian Imperial Academy established a series of magnetic and meteorological stations from Saint Petersburg to Peking, which was followed, on Humboldt's application to the Duke of Sussex, by the establishment of similar stations in the southern hemisphere by the British government. The convulsions of 1830 gave a more political direction to Humboldt's activity for several years. On the news of the French Revolution, and the accession of Louis Philippe, he was selected to convey to Paris the Prussian recognition of the new monarch, and to send political advices to Berlin. The latter office fell to him again in 1834–35, and he was called upon to fulfil it five times in the 12 following years, residing four or five months in Paris on each mission. To this period belongs the publication of his ‘Examen critique de la Géographie du Nouveau Continent’ (1835–38). He accompanied the king of Prussia in visits to Denmark, England, etc. (1841–45), and resided for several months in Paris in 1847–48, from which time he lived in Prussia, usually in Berlin, occupying a high position at the court until his death. His last great work, ‘Cosmos’ (1845–58), has been unanimously recognized as one of the most valuable contributions to science ever published. It explains the physical universe according to its dependencies and relations, grasps nature as a whole, moved and animated by internal forces, and by a comprehensive description shows the unity which prevails amid its variety. It has been translated into all languages in which a book of science is required, and has been without an equal in giving an impulse to natural studies. Consult Bruhns, ‘Alexander von Humboldt, eine Wissenschaftliche Biographie’ (English trans., 1873); Klenke, ‘Alexander von Humboldt, ein biographisches Denkmal’ (1859).

HUMBOLDT, Karl Wilhelm, Baron von, German statesman and philologist, brother of the preceding: b. Potsdam, 22 June 1767; d. Tegel near Spandau, 8 April 1835. He studied law at Berlin, at Frankfort-on-the-Oder and at Göttingen, and at the same time devoted equal attention to antiquities, æsthetics and the philosophy of Kant. In 1789–90 he lived in Erfurt and Weimar, where a friendship commenced with Schiller continued without interruption till the poet's death. A valuable memorial of his friendship with Schiller is the correspondence between them (‘Briefwechsel zwischen Schiller und Wilhelm von Humboldt,’ 1830). In 1790 he became Prussian Councillor of Legation at Berlin, resigning in the following year. From 1794–97 he was one of the Schiller circle at Jena. In 1801, at the request of the Prussian government, he accepted the situation of ministerial resident at Rome. From 1806–08 he was here Minister Plenipotentiary, but, having been called from Rome to fill the office of Minister of the Interior in connection with ecclesiastical and educational matters, had a most important share in the educational progress which Prussia has since made; more especially

FRIEDRICH HEINRICH ALEXANDER VON HUMBOLDT

is the erection of the Berlin University to be ascribed to him. In 1809 he was appointed Privy Councillor of State, and in this office was in charge of public worship and education. He exchanged this situation in 1810 for that of Extraordinary Ambassador and Minister Plenipotentiary to Vienna. He took an active part during the armistice of 1813 in the peace congress at Prague; in 1814 at the Congress of Chatillon, and the conclusion of the first Paris peace; in 1815 at the Congress of Vienna; and in 1816 at Frankfort-on-the-Main, in all matters connected with the German Diet. He was afterward appointed Ambassador to London, and in 1818 attended the Congress of Aix-la-Chapelle. In 1819 he was an active member of the Prussian Ministry of the Interior, but sent in his resignation the same year, in favor of a freer and more constitutional system. It was not until 1830 that Humboldt was recalled to the Council of State. His publications include the elegiac poem ‘Rom’ (1808); the important work in philological research in the Basque language ‘Prüfung der Untersuchungen über die Urbewohner Hispaniens vermittelst der baskischen Sprache’ (1821); also ‘Uber die Kawisprache auf der Insel Java’ (3 vols., 1836–40); ‘Ideen zu einem Versuch, die Grenzen der Wirksamkeit des Staates zu bestimmen’ (ed. by Cauer in Reclam's ‘Universalbibliothek’ 1851). Humboldt's philological studies were the first in this field to be based on history, philosophy and the various anthropological sciences. His collected works appeared in seven volumes (Berlin 1841–52). Consult Haym, R., ‘Wilhelm von Humboldt, Lebensbild und Charakteristik’ (Berlin 1856); Gebhardt, ‘Wilhelm von Humboldt als Staatsmann’ (2 vols., Stuttgart 1896–99); and Kittel, ‘Wilhelm von Humboldts geschichtliche Weltanschauung’ (Leipzig 1901).

HUMBOLDT, Kan., a city in Allen County, 60 miles southeast of Emporia, on the Neosho River. The Missouri, Kansas and Texas and the Atchison, Topeka and Santa Fe railroads connect with the town. Th. chief occupations are the mining of oil, and the manufacture of tile, bricks, cement and flour. Oil refining and agriculture are also carried on. The city owns its waterworks. Pop. 2,600.

HUMBOLDT, Tenn., a city in Gibson County, 85 miles east of Memphis. It is situated on the Forked Deer River and is served by the Mobile and Ohio and the Louisville and Nashville railroads. It is a shipping centre for the surrounding region which grows cotton and fruit. There are marble and granite works, cotton mills, brickyards, canning factory and cotton gins. The municipality operates its own waterworks and electric-light plant. Pop. 3,500.

HUMBOLDT, a river which has its rise in Elko County, Nevada, in the northeast corner of the State, and flows west and southwest, a distance of about 350 miles into Humboldt Lake, in the eastern part of the State. The stream is narrow, the waters saline and the whole course is through a barren region, destitute of large trees and but few shrubs, except a few clusters of willows. The fields are covered with sage brush. The only east and west pass through the mountains of Nevada, which rise to a height of 11,000 feet above sea-level, is the valley of the Humboldt. The Central Pacific Railroad, in its course through the State, follows this river. Humboldt Lake has no outlet; but the waters evaporate so rapidly that sometimes its bed is dry, but when the water is high it overflows the banks. A dam built a few years ago prevents the overflow from falling in Carson Sink.

HUME, David, Scottish historian and metaphysician: b. Edinburgh, 26 April 1711; d. there, 26 Aug. 1776. He appears to have entered the University of Edinburgh at 12 and to have left at 14 or 15 without taking a degree. He began the study of law, but abandoned it first for commerce and then in order to devote himself to the “pursuits of philosophy and learning.” These he carried on in France, largely at the Jesuit school of La Flèche. His first work, the ‘Treatise of Human Nature,’ was published partly in 1739 and partly in 1740; the books entitled ‘Of the Understanding’ and ‘Of the Passions’ appearing in the former, and that entitled ‘Of Morals’ in the latter year.

The ‘Treatise of Human Nature’ is the final and most complete exposition of the fundamental principles of the old school of empirical philosophy,— the school to which belonged Bacon, Locke and Berkeley. According to Hume, the contents of the mind are embraced in the term “perceptions.” Perceptions consist of sensuous impressions and ideas. Ideas are merely faded-out sensuous impressions. Knowledge is the cognition of the relation between perceptions. There is no necessary connection between cause and effect. The idea of cause depends on the habit of the mind which expects the event that usually follows another. Mind — and it is precisely this point that Hume transcends Berkeley — is but an isolated series or succession of impressions and ideas. As knowledge is dependent on experience derived through the senses, and as the senses frequently deceive, one can have no absolute knowledge of things, but only of one's impression of them. Or rather, there are no things apart from experience, but merely chains of experiences which constitute the things. Hence, to give the conclusion later arrived at in the famous ‘Essay on Miracles,’ a miracle even if genuine is incapable of proof.

The ‘Treatise of Human Nature’ is clear, forcible and untechnical. Its most striking characteristics are its spontaneity and individuality. Hume owed little to academic training, and wrote his earlier works at a distance from centres of learning, without access to large libraries. The literary beauties of the ‘Treatise,’ however, are marred by its structural defects. It is a series of brilliant fragments rather than a well-rounded whole, and is concerned more with criticism of metaphysical opinions from the point of view of Hume's theory of knowledge than with the construction of a complete system of philosophy, yet this lack of system-making can scarcely be held up against a man whose chief contribution to philosophy was of the nature of a destructive criticism of the old notions of substance. The ‘Treatise’ failed to excite the interest and antagonism which Hume confidently expected. He therefore turned his activity in the direction of political investigation.

In 1741 appeared the first volume of ‘Essays, Moral and Political,’ the second volume coming out in the following year. These, with some additions and omissions, were republished in 1748 under the expanded title, ‘Essays, Moral, Political and Literary,’ which has been retained in the many subsequent editions. In 1744 Hume failed to receive an appointment to the chair of ethics and pneumatic philosophy at Edinburgh on account of the reputation for unorthodoxy, which the ‘Treatise’ has engendered. Hume's essays are models of their kind, full of sparkle, interest and animation. Hume accompanied General Sinclair in 1746 and 1747 in his expedition against France and in a military embassy to Vienna and Turin. He now published a recasting of his ‘Treatise upon Human Nature,’ under the title ‘An Enquiry Concerning the Human Understanding’ (1747). In 1752 he published his ‘Political Discourses’ which were well received, having the previous year published his ‘Enquiry Concerning the Principles of Morals.’ The posthumous ‘Dialogues on Religion’ belong to the same period. That year he obtained the appointment of librarian of the Advocates' Library at Edinburgh, and began to write his ‘History of England,’ of which the first volume appeared in 1754. It was, like most of the succeeding volumes, severely attacked both for its religious and political tendencies; but, in spite of adverse criticism, after its completion in 1762 was recognized as a standard work. Its merits are chiefly clearness and force of narrative and philosophical breadth of view in the judgment of men and event. In 1757 came ‘Four Dissertations: the Natural History of Religion; of the Passions; of Tragedy; of the Standard of Taste.’ In 1763 he accepted an invitation from the Earl of Hertford, then proceeding as Ambassador to Paris, to accompany him, and was enthusiastically received by Parisian circles in his character of philosopher and historian. After the departure of Lord Hertford, he remained as chargé-d'affaires, and returned to England in 1766, bringing with him Rousseau, for whom he procured a pension and a retreat in Derbyshire. But the morbid sensitivity of Rousseau brought about a disagreement which put an end to the friendship. In 1767 Hume was appointed Under-Secretary of State, a post which he held till 1769.

Hume's philosophical fame rests primarily on the fearless and unrelenting way in which he carried to their logical conclusion the implicit assumptions of the Empiricist school of Great Britain and, for the matter of that, of the entire philosophy of the Enlightenment. Among the most important heirlooms handed down to the Enlightenment from the Schoolmen was the notion of substance.

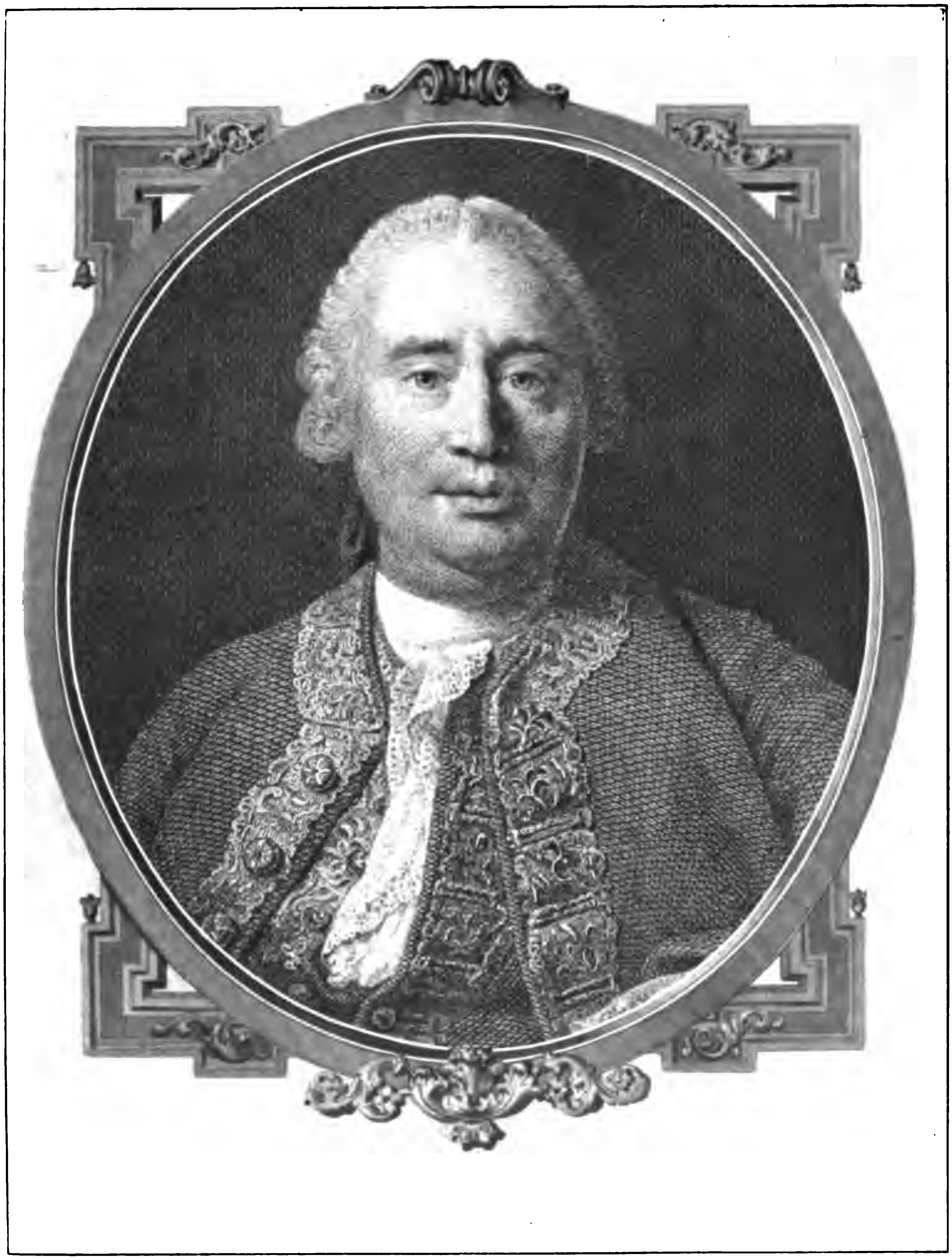
The Aristotelian logic made every proposition essentially the attribution or denial of some predicate to some subject. As a natural and even necessary consequent of this, the Middle Ages and the Enlightenment viewed every relation under the aspect of a subject-predicate relation. The tendency, moreover, was to regard certain entities, not merely as in the situation of subjects, but as subjects in their very essence, and others as essentially predicates. Locke already saw that if every fact is a predication of an attribute to a subject, and if such a predication, as he thought, consists in the modification of the subject by the predicate, the unmodified subject or substance is not susceptible to any cognition in the least analogous to that which we have of the modified subject. Berkeley took the next step, saw that an unknowable substratum is useless for explanatory purposes and ousted substance from the material world. However, he retained the old substantial notion of unity essentially unmodified in his explanation of the unity of consciousness — the soul. It was left to Hume to expel substance from its last hiding-place, and to view mind and matter alike as mere aggregates of impressions and ideas in essence no more mental than material.

It is important to note that Hume, no less than his predecessors, retained the opinion that unity is essentially of a substantial character. For this reason he interpreted his reputation of the substantial character of consciousness as a refutation of all intrinsic unity whatever which consciousness might possess. This led to his associationism: he believed that ideas group themselves together according to the principles of “resemblance contiguity in time or place, and cause and effect.” Owing to his inability to understand relations as apart from substance, and owing, moreover, to the imperfect development of the notions of infinite and infinitesimal which characterized all his predecessors and contemporaries, he was forced to view time and space as mere aggregates formed by the juxtaposition of a finite number of minima divisibilia. Cause comes to be merely an idea produced in the mind by the constant concomitance of two states and their resulting association.

Hume left the universe of his philosophy in danger of falling to pieces from sheer lack of any principle of cohesion — indeed, of any principle at all. It is space and time are aggregations without arrangement; his cause in coexistence without connection. It is this destruction of the unity of the older systems which has given Hume a reputation for scepticism. Hume's chief work is destructive, yet by this very destruction he showed the necessity and prepared the way for a theory of the universe which should not found its unity on the insecure basis of substance. The first definite step toward this theory was taken by Kant, whom Hume “wakened from his slumber.”

In ethics Hume is a utilitarian. He believes that pleasure and pain are the only springs of action, and that utility to the race is the end of all good action. While he emphasizes the share played by intuition in all ethical matters, he does not deny all efficacy to reason. He is a rigid determinist. Consult Burton, J. H., ‘Life and Correspondence of David Hume’ (Edinburgh 1840); Gizycki, Georg von, ‘Die Ethik David Humes’ (Breslau 1878); Hume, D., ‘My Own Life’ (London 1777); Huxley, T. H., ‘David Hume’ (London 1879); Hyslop, J. H., ‘The Ethics of Hume’ (Boston 1893); Jodl, ‘David Humes Lehre von der Erkenntniss’ (Halle 1871); Knight, W., ‘Hume’ (Edinburgh 1886); Orr, J., ‘David Hume and his Influence on Philosophy and Theology’ (New York 1903); Seth, A., ‘English Philosophers and Schools of Philosophy’ (London 1912).

HUME, Fergus, English novelist: b. 24 July 1862. He was educated at the University of Otago, New Zealand, became a barrister, and in 1888 removed to London. His first long work, ‘The Mystery of a Hansom Cab,’ published in Melbourne (1887), and later in London, achieved a phenomenal circulation. Later



DAVID HUME

publications are 'The Piccadilly Puzzle' (1889); 'Miss Mephistopheles' (1890); 'A Creature of Night' (1891); 'An Island of Fantasy' (1894); 'The Bishop's Secret' (1900); 'The Turnpike House' (1902); 'The Mandarin's Fan' (1904); 'Jonah's Luck' (1906).

HUME, Joseph, English politician: b. Montrose, Forfarshire, 22 Jan. 1777; d. Norfolk, 20 Feb. 1855. He studied medicine at Aberdeen, Edinburgh and London, and in 1796 became a member of the College of Surgeons of Edinburgh. In the following year he became assistant surgeon in the sea-service of the East India Company, and after several years of service was transferred to the land company. Having mastered Hindustan and Persian, he was employed by the government in political duties. He acted in the capacity of surgeon and interpreter in the Mahratta War and filled several high posts during that time. Returning to England in 1808, he spent several years in travel and study, and then began to take an active interest in politics. He represented Weymouth in Parliament from 1812, re-entering in 1818, and remained there until his death, for 30 years being a leader of the Radical party. He published a translation in blank verse of the 'Inferno' of Dante (1812). Hansard's 'Parliamentary Debates' are the best record of his incessant political activity. His letters were published by Cornewall Lewis (1894).

HUME, Martin Andrew Sharp, English historian: b. London, 8 Dec. 1847; d. 1 July 1910. He was educated in Madrid, became a major in the British army and was attached to the Turkish army 1878–79. He was editor of Spanish State Papers in the Public Record Office and examiner of Spanish in the University of London. He was a distinguished authority on Spanish history and literature and was the author of numerous books on the Spain of Philip II, and Elizabethan England.

HUMIDITY. See CLIMATE; METEOROLOGY.

HUMMEL, Johann Nyomuck, Austro-Hungarian composer and pianist: b. Pressburg, 14 Nov. 1778; d. Weimar, 17 Oct. 1837. His father became music-director in one of the theatres of Vienna, and removed his family there when the boy was seven years old. In Vienna he attracted the notice of Mozart, who took him into his own family and taught him for more than two years. The boy's talent seems to have made a great impression on all the musicians with whom he came in contact, and the list of his teachers takes in most of the masters of the day, including Haydn. So great was his success and appreciation that he was at one time considered to be a rival to the great Beethoven. When he was only nine years old his father took him on a two years' concert tour through Germany, Denmark, Scotland, England and Holland, in all of which countries he was greatly admired as a pianist. In 1791–92 he lived in London, where his first composition, 'Variations for the Piano,' was published. He returned then to Vienna and studied composition, etc., under Albrechtsberger, Salieri and others. From about 1803–11 he was in the service of Prince Nicholas Esterhazy. He justly ranks among the best pianists of the time, and his chief importance in music is due to his efforts to introduce correct and scientific fingering in piano playing. He traveled and taught music in Vienna from 1811–16. In the latter year he accepted a call as royal orchestra leader at Stuttgart, where he remained until 1820. In the same capacity he went then to Weimar, where he remained until his death, except for a trip to Paris and London in 1830, and to Dresden, Vienna and Italy in 1834. While his compositions number among the hundreds, only comparatively few have survived the test of time. Among these should be mentioned 'Septett' (Op. 74); some of his masses (Op. 77 and 80); various 'Rondo' (Op. 11, 49, 120); 'Variation' (Op. 57); and a number of lesser pieces for the piano. A complete list of his compositions may be found in Eitner, 'Quellen-Lexikon der Musiker und Musikgelehrten' (Vol. V, Leipzig 1901); and in Grove, 'Dictionary of Music and Musicians' (Vol. II, New York 1911). His important book on piano-playing, 'Ausführliche Theoretisch-Praktische Anweisung zum Pianofortespiele, etc.' (3 parts, Vienna 1828), has been published also in English, French and Italian editions. Consult Neumann, W., 'Die Componisten der Neueren Zeit' (Heft 99–102, Cassel 1857).

HUMMING-BIRDS, a family of small birds, the *Trochilidæ*, closely allied to the swifts, peculiar to America and almost exclusively tropical. They are distinguished by small size, iridescent plumage, long slender bill and the peculiar form of the tongue, which consists of a double tube tapering and separating at the tip into two externally lacerated sheaths, which contain the extensile portion. "The horns of the hyoid apparatus are greatly elongated, and pass round and over the back of the head, meeting near the top, and thence stretching in an ample groove to terminate in front of the eyes. This arrangement, analogous to that found in woodpeckers, allows the tongue to be suddenly protruded to a considerable distance, and withdrawn again in an instant." This is a modification of parts adapted to food-getting habits, and is accompanied by others equally characteristic. Humming-birds feed almost entirely upon minute living insects, especially those that gather about flowers and loiter in the corollas, feeding upon the nectar; or dwell on the leaves and bark of plants and trees. Such honey as may be taken with them seems to be gratefully accepted, but the birds do not seek for, nor "suck" the nectar from flowers, as has been popularly supposed. They will dart from a perch and capture an insect like a flycatcher, but ordinarily they obtain them by poising upon their wings about leaves and in front of tree-trunks, picking up morsels, not with the mandables, but with the tongue; and still more frequently by searching flowers. As it is in the deep, tubular, sweet corollas of trumpet-creepers, orchids and similar great blossoms of tropical shrubs and vines that insects most abound so there does the humming-bird find its richest hunting-ground; and the long curved beaks of most species have been developed in the constant effort to penetrate to the nectarous depths of these deep blossoms; in truth, the head and half the tiny body may often be pushed into the flower, and in so doing gather and dispense pollen from flower to flower, so that humming-birds are important if not exclusive agents in the cross-fertilization of certain large flowered plants. (See FLOWERS, FERTILIZATION OF

BY BIRDS). This method of obtaining food requires the power of sustaining themselves in the air in a fixed position while they explore leaves or blossoms, since no perch is available for their feet, which are small and weak at best. Hence humming-birds have developed lightness of body coupled with extraordinary muscularity and extent of wings, which in most species reach far beyond the root of the tail. These long narrow wings are operated by pectoral muscles that proportionately exceed in size those of any other bird,— even those of the chimney-swifts; and these huge muscles actuate remarkable short wing-bones, so that extreme rapidity of movement is possible, but it is accompanied by a loss of that power secured by the relatively longer alar bones of other birds. By this apparatus the humming-birds are able to beat the air with a rapidity which enables them to sand still, or to dart and dodge in pursuit of some agile insect, or in escaping danger, with a speed which defies human sight to trace; the moving wings at such times, indeed, appear only as a misty halo about the body of the bird, and make a loud humming noise. Most species have very long bills — frequently exceeding, and sometimes twice as long as the head; but some have short, awl-like beaks, with which they pierce the base of such flowers as are too deep for them.

A characteristic of humming-birds is that flashing beauty of plumage which long ago led to calling them the gems of the air, and is due mainly to the quality of the feathers, upon the surface of which are small scales that reflect the light in prismatic hues, giving an iridescent or metallic sheen to certain parts, especially the throat (gorget), comparable only to the shards of some beetles. Such brilliance, however, belongs only to the males, the females being uniformly more plainly dressed, though still highly colored. In many species, also, the males are further adorned with fanciful crests, mustaches, tufts, pendants of the chin and throat, "puffs" upon the legs, and especially with ornamental developments of the tail-feathers; and these they seem to take great delight in displaying for the admiration of the female, and the exasperation of rivals. They are extremely pugnacious, especially in the nuptial season, when constant and bitter fighting occurs, and their courage is so great that neither sex has any hesitation in attacking any bird that offends them or comes too near the nest,— even hawks and crows often flee ignominiously before the impetuous onslaughts of these little furies. On the other hand no bird is more fearless of man.

The nests of humming-birds are small cups of downy materials, sometimes resting upon the limb of a tree (as is the method with the common ruby-throat of the eastern United States; sometimes fastened in a crotch of a bush or of large leaves; or fastened to the tip of a pendant leaf, or in a bunch of hanging moss or foliage. The materials are adapted to the place in color and appearance, and further concealment is gained by coating the structure with lichens, or bits of bark, or with cone-scales, as is the habit of the familiar Calliope hummer of California, which nests in pine trees. The eggs of all species are only two in number and purely white.

The family is exclusively American, and is represented from Labrador and southern Alaska to Patagonia; but the more vagrant species are few, and withdraw in winter toward the equator. About 125 genera with some 500 species are recognized by ornithologists. Nine-tenths of them belong to the Amazon and Orinoco valleys, or to the lowlands of Central America; yet some species habitually spend the summer on high mountains. The variety decreases northward, but nearly 20 species reach the boundary of the United States and several are regularly present in summer west of the great plains as far north as southern Alaska. One species wanders over the whole country, and is abundant in the Eastern States. This is the ruby-throat (*Trochilus colubris*). It is about three and one-half inches long. The whole upper part, sides under the wings, tail coverts and two middle feathers of the tail are rich golden green; the tail is forked, and, as well as the wings, of a deep brownish purple; the bill and eyes black; but what constitutes their chief ornament is the splendor of the feathers on the throat of the male, which are ruby-red, and gleam like a great jewel. The females and immature young lack this gorget.

The Anna humming-bird (*Calypte annæ*), with crown and throat glittering purplish-pink; the broad-tailed (*Selasphorus platycercus*), green, with pink throat; the rufous (*S. rufus*), back reddish brown, gorget red; Allen's (*S. alleni*), crown and back green, tail rusty; and the calliope (*Stellula calliope*), very small, green above, throat purplish-pink, mixed with white; are more or less common and widespread summer visitors to the Pacific slope.

Bibliography.— Jardine, 'Naturalists' Library' (Vols. I and II, Edinburgh 1833); Lesson, 'Histoire Naturelle des Colubris' (1830); Gould, 'Monograph of the Trochilidæ' (5 vols., 1850–95); Mulsant and Verreaux, 'Histoire Naturelle des Oiseaux-Mouches ou Colubris' (4 vols., 1876); Ridgway, 'The Humming-birds' (Am. Rept. United States National Museum for 1890, Washington 1892).

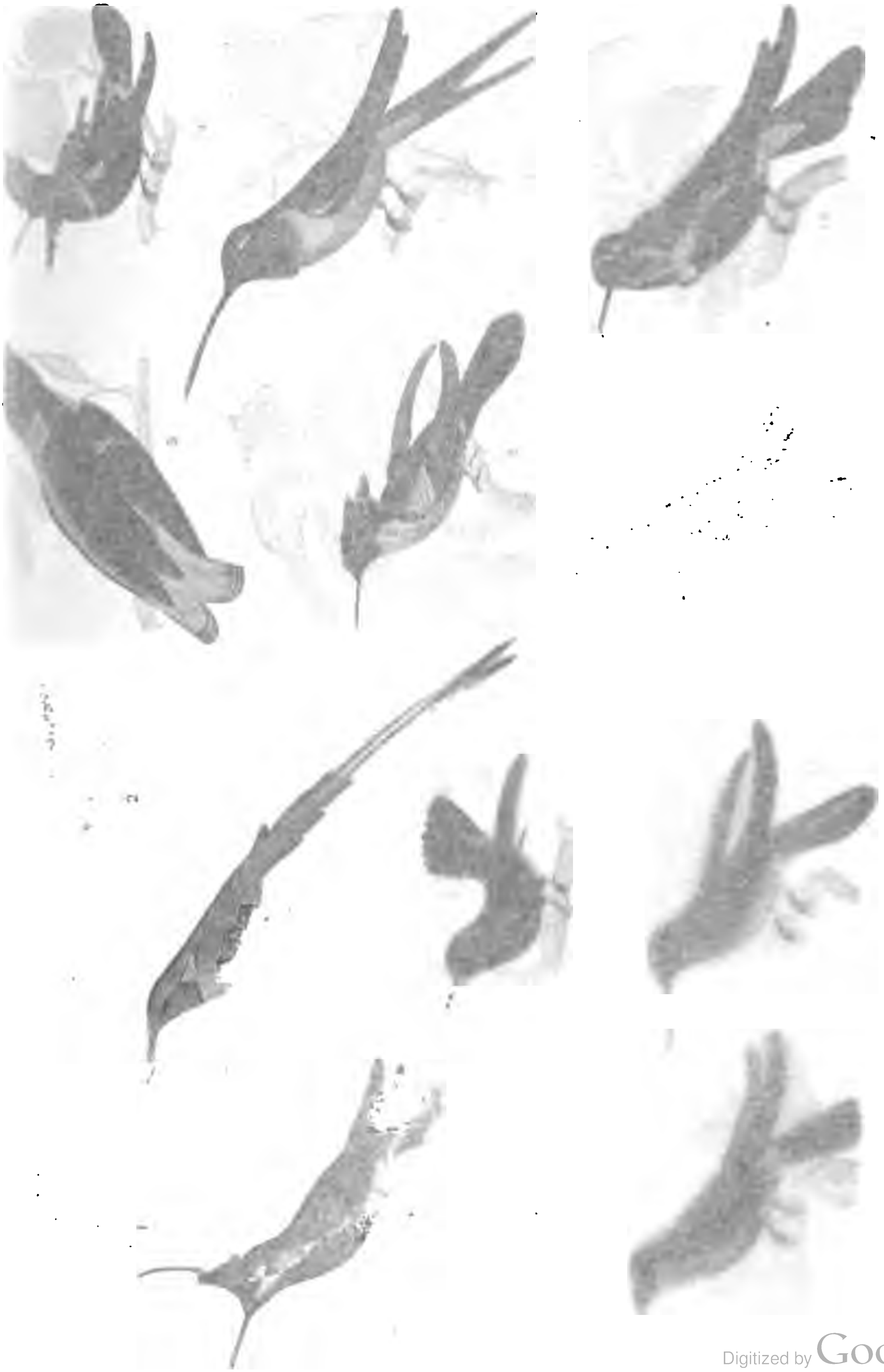
ERNEST INGERSOLL.

HUMOR, a fluid of the living body, of which Hippocrates enumerated four, namely, blood, phlegm, yellow bile and black bile. These were considered to be the principal seats of disease in man. In modern medicine humor is a term generally applied to the thinner fluids, whether natural or morbid, limpid, serous or sanious, such as the humors of the eye or the watery matter in a blister of the skin caused by heat, etc.

HUMORESKE, hu'mō-rĕsk'. The word first came into prominence when applied by Schumann to short musical compositions, free and whimsical in form and strikingly original in harmony and rhythm. The popular "Humoreskes" of Grieg and Dvořák have made the term a familiar one.

HUMPBACK SALMON, Whitefish, etc., several kinds of fishes are said to be "humpbacked" because of an unusually raised dorsal outline. The humpback salmon of the Pacific coast is a commonly known but little valued species (*Oncorhynchus gorbuscha*), whose flesh is styled in market "pink" salmon. (See SALMON). The common whitefish (q.v.) is known locally as humpback or bowback; and the curious razor-backed sucker (*Xyrauchen cypho*), is locally called the humpback.

HUMMINGBIRDS



[illegible] are [illegible] ants, [illegible] tests or [illegible] eggs, and [illegible] essential [illegible] of the [illegible]; and these [illegible] to take [illegible] displaying [illegible] admiration [illegible] and the ex[illegible]ation of [illegible] extremely pug[illegible], especially [illegible] season, wh[illegible] [illegible] and [illegible] urs, and their [illegible] is [illegible] her sex has any [illegible] any bird that offends [illegible] or [illegible] the nest,— even hawks and [illegible] ignominiously before the [illegible] On the [illegible] is more fearless of man.

[illegible] of humming-birds are small cups of [illegible] materials, sometimes resting upon th[illegible] tree (as is the method with the common ruby-throat of the eastern United States), sometimes fastened in a crotch of a [illegible] of large leaves, or fastened to the tip of a pendant leaf, or in a bunch of hanging moss or foliage. The materials are [illegible] to the place in color and appearance, and further concealment is gained by coating the structure with lichens, or bits of bark, [illegible] with cone scales, as is the habit of the [illegible] C[illegible] hummer of California, wi[illegible] pine trees. The eggs of all species [illegible] two in number and purely white.

The family is exclusively American, and is represented from Labrador and southern [illegible]; but the more vagr[illegible] and withdraw in winter towa[illegible] at 125 genera with some [illegible] recognized by ornithologists. N[illegible] belong to the Amazon [illegible] to the lowlands of Ce[illegible] some species habitually spe[illegible] mountains. The variety [illegible], but nearly 20 species [illegible] the United States and [illegible] present in summer [illegible] as far north as south[illegible] species wanders over the wh[illegible] abundant in the Eastern St[illegible] ruby-throat (*Trochilus colubr*[illegible]) [illegible] and one-half inches long. [illegible] sides under the wings, [illegible] middle feathers of the [illegible] green; the tail is forked, [illegible] wings, of a deep brow[illegible] and eyes black; but what [illegible] chief ornament is the splendo[illegible] the throat of the male, w[illegible] gleam like a great jewel. [illegible] that the young lack this gem [illegible] humming-bird (*Calypte an*[illegible]) [illegible] and throat glittering purp[illegible] broad-tailed (*Selasphorus p*[illegible]) [illegible] pink throat; the ru[illegible] brown, [illegible] and back green [illegible] (*Stellula calliope*), [illegible] purplish-pink, [illegible] or less common [illegible] visitors to the Pacific [illegible] 'Naturalist[illegible] I and II, Edinburgh 18[illegible] 'Histoire Naturelle des C[illegible] 'Monograph of the Trochilidæ' (5 vols., 1861-87); Mulsant and Verreaux 'Histoire Naturelle des Oiseaux-Mouches ou Colibris' (4 vols. 1876); Ridgway 'The Hum[illegible] Rept. United States National Museum for 1890, Washington 1892).

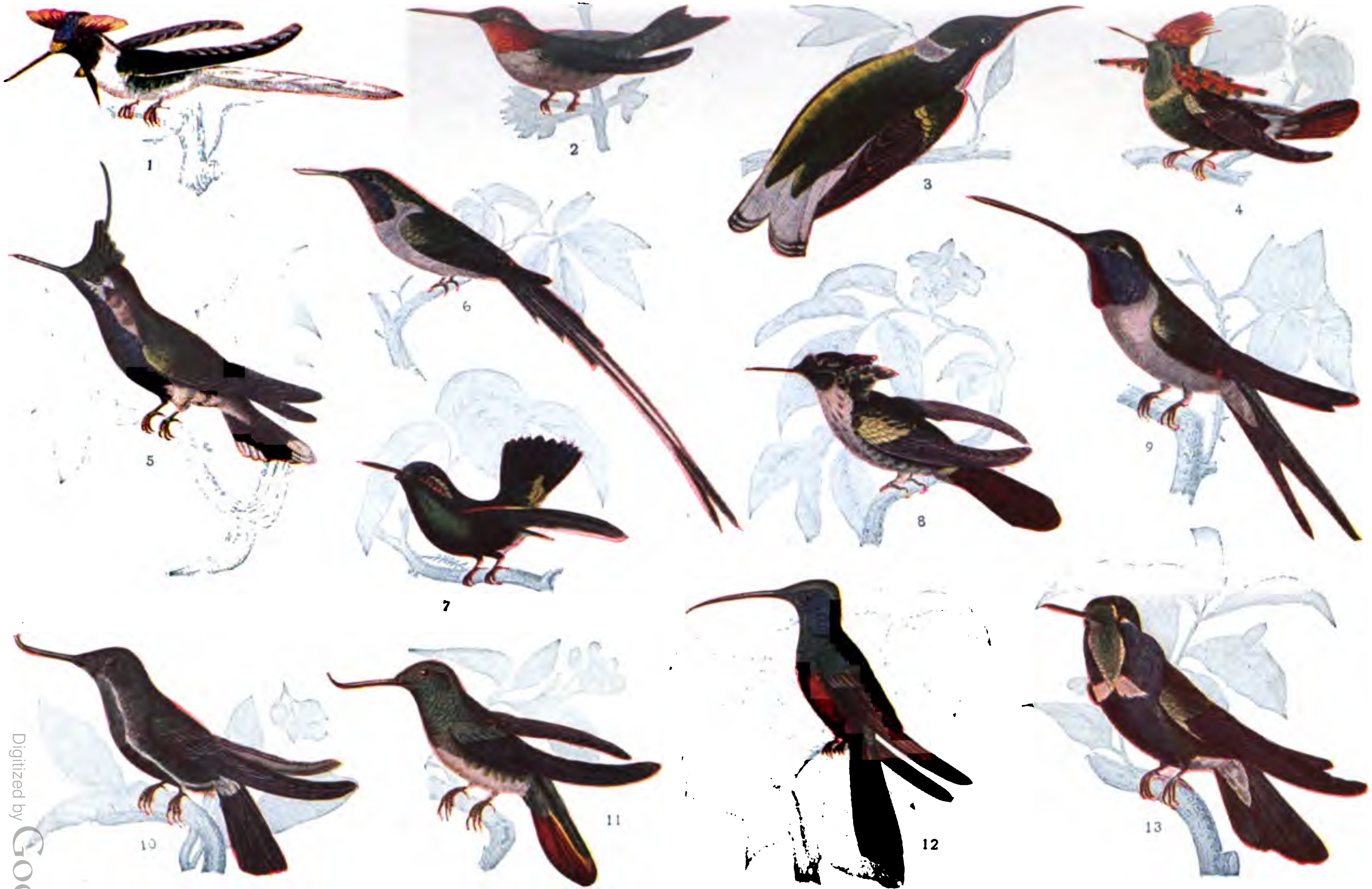
ERNEST INGERSOLL.

HUMOR, a fluid of the living body [illegible] which Hippocrates enumerated four, namely [illegible] phlegm, yellow bile and black bile. The[illegible] were considered to be the principal seats [illegible] disease in man. In modern medicine humor is a term generally applied to the thinner fluids whether natural or morbid, limpid, serous [illegible] sanious, such [illegible] humors of the eye or [illegible] watery matter [illegible] blister of the skin caused by heat [illegible]

HUMORESQUE, hū'mō-rĕsk'. The wo[illegible] [illegible] when applied [illegible] musical compositions, [illegible] and strikingly orig[illegible] [illegible]am. The popular [illegible] [illegible]d Dvorák have made the [illegible]

HUMPBACK SALMON, Whitefish, etc. [illegible] are said to be "hump[illegible] unusually raised dors[illegible] salmon of the Pacific [illegible] known but little valu[illegible] (*Oncorhynchus gorbuscha*) wh[illegible] styled in market "pink" salmon [illegible] SALMON). The common whitefish (q.v.) is known locally as humpback or bowback; and the [illegible] razor-backed sucker (*Xyrauchen* [illegible]), is [illegible] called the humpback.

HUMMINGBIRDS



1. Double-crested (T. cornutus). 2. Ruby-throat (Trochilus colubris). 3. White-collared (T. melivorus). 4. Tufted-neck (T. ornatus). 5. Delande's (T. delandii). 6. Cora's (T. cora). 7. Golden-green (T. prasina). 8. Vieillot's (T. chalybeus). 9. Evening (T. vesper). 10. Avocet-billed (T. avocetta). 11. Curve-bill (T. curvirostris). 12. Harlequin (T. multicolor). 13. Natterer's (T. scutatus).

HUMPBACK WHALE, one of the baleen whales or rorquals (q.v.) of the genus *Megaptera*, characterized by a low hump in place of the inconspicuous dorsal fin and a tuberculous head. The genus is world-wide, and an undetermined number of species exist, of which the best known is the northern *M. longimanus*, the specific name referring to the elongated pectoral fin, with which the animal beats the water, itself and often its playmates. These whales reach 50 or 60 feet in length, and go about in small schools. See WHALE.

HUMPERDINCK, Engelbert, ĕng'ĕl-bĕrt hoom'pĕr-dink, German composer: b. Siegburg, near Bonn, 1 Sept. 1854; after studying music at Cologne and elsewhere he taught in the conservatories of Barcelona and Cologne, and was musical adviser to a publishing firm in Mainz. Wagner asked him to assist in the production of the latter's only symphony; and he prepared and coached the first cast of ‹Parsifal› at Baireuth (1882). He subsequently became famous as the author of the phenomenally successful children's musical fairy play, ‹Hänsel und Gretel› (1894); followed by ‹Schnee-Mädchen› (The Snow Maiden), ‹The Royal Children› and other operas, with incidental music to fairy plays and dramas, distinguished by appealing melody, harmony and orchestration.

HUMPHREY, hŭm'frĭ, **Charles Frederic;** American soldier: b. New York, 2 Sept. 1844. He served in the 5th Artillery in the Civil War, became first lieutenant of the 4th Artillery in 1868, was transferred to the quartermaster's department in 1879 as assistant quartermaster with captain's rank; distinguished «for gallant service in action against the Indians» when on 11 July 1877 he recovered abandoned guns. In 1897 he attained the post of deputy quartermaster-general with grade of lieutenant-colonel. In 1898 he entered the volunteer service, participated in the Cuban expedition and was promoted brigadier-general of volunteers. In 1899–1900 he was chief quartermaster of the division of Cuba; in 1900 of the United States China relief expedition. In 1903 he was appointed quartermaster-general, United States army, with rank of brigadier-general, retiring 1 July 1907 after over 44 years of service.

HUMPHREY, Heman, American Congregational clergyman and college president: b. West Simsbury, Conn., 26 March 1779; d. Pittsfield, Mass., 3 April 1861. He was graduated from Yale in 1805, was pastor of the Congregational church at Fairfield, Conn., 1807–17, and of that at Pittsfield, Mass., 1817–23, while from 1823 to 1845 he was president of Amherst College. He published several works, including a popular ‹Tour in France, Great Britain, and Belgium,› but is best known by a famous pamphlet called the «first temperance tract» and entitled ‹Parallel Between Intemperance and the Slave Trade.› Consult Tyler, W. S., ‹History of Amherst College› (Springfield 1873).

HUMPHREY GAS PUMP. See INTERNAL COMBUSTION ENGINE.

HUMPHREYS, Alexander Crombie, American mechanical engineer and educator: b. Edinburgh, Scotland, 20 March 1851. His family settled in Boston in 1859 and he was educated by his father, an English classical scholar. He passed preliminary examinations for entrance to the United States Naval Academy, but disbarred by youth began to work in 1866, and by 1872 had reached a point of responsibility, when he was made secretary and shortly afterward superintendent of the Bayonne and Greenville Gas-Light Company. While in this position he studied and was graduated from Stevens Institute of Technology in 1881, shortly after being appointed chief engineer of the Pintsch Lighting Company of New York. From 1885 to 1892 he was general superintendent of the United Gas Improvement Company of Philadelphia, rebuilding and reorganizing the gas and electric properties and reducing the management to a system of high efficiency. He became senior member of the firm of Humphreys & Miller of New York city; president of the Buffalo Gas Company; and president of the faculty (since 1902) and of the trustees (since 1907) of the Stevens Institute of Technology. He received the degrees of Sc.D., University of Pennsylvania 1903; LL.D., Columbia 1903; New York University 1906; Princeton 1907. He is a member and official of numerous learned and scientific societies and the author of a great number of papers on engineering education and the economics of gas engineering, including ‹Business Features of Engineering Education› (1905).

HUMPHREYS, Andrew Atkinson, American soldier: b. Philadelphia, Pa., 2 Nov. 1810; d. Washington, D. C., 27 Dec. 1883. He was a grandson of Joshua Humphreys (q.v.) and was graduated at West Point 1831, receiving a commission in the artillery. He took part in the Seminole War. Resigning in 1836 he was associated with Maj. Hartman Bache as a civil engineer in government work. He reëntered the army in 1838, joining the newly-founded corps of topographical engineers, was detailed in 1844 to the Coast Survey office and was engaged in several government surveys, especially in connection with the Mississippi River delta. In 1854 he was detailed to the supervision of the surveys of railroad routes to the Pacific. In 1856 he became a member of the Lighthouse Board. In the Civil War he was chief topographical engineer to the Army of the Potomac. In 1862 he was made brigadier-general and commanded the 5th corps of the Army of the Potomac at the battles of Fredericksburg and Chancellorsville. He commanded a division in the battle of Gettysburg and earned promotion to a major-generalship in the volunteer forces. He then became chief of staff of General Meade. He commanded the 2d corps of the Army of the Potomac in the campaign which closed with Lee's surrender. After his services at Sailor's Creek, he was brevetted major-general in the regular army and was subsequently placed in command of the engineer corps with the regular rank of brigadier-general. Throughout his career during the Civil War he displayed the greatest courage and wisdom and was one of the most successful commanding officers on the Union side. These characteristics, combined with great administrative ability and untiring industry, made him equally successful as commander of the engineer corps. He was retired at his own request in 1879.

He held the honorary degree of LL.D. from Harvard and was a member of the American Philosophical Society, National Academy of Sciences and of numerous other domestic and foreign scientific bodies. He wrote ‘Preliminary Report Concerning Explorations and Surveys principally in Nevada and Arizona’ (Washington 1872); with H. L. Abbott, ‘Report upon the Physics and Hydraulics of the Mississippi River, etc.’ (Washington 1876); ‘The Virginia Campaigns of 1864 and 1865’ (New York 1882); ‘From Gettysburg to the Rapidan’ (New York 1882); ‘Historical Sketch of the Corps of Engineers’ in *Occasional Papers No. 16* (United States Army, Engineer School, Washington 1904). Consult Abbott, H. M., ‘A. A. Humphreys’ (in *Science*, Vol. III, p. 476, New York 1884); De Peyster, J. W., ‘A. A. Humphreys’ (in *United Service*, Vol. X, p. 254, Philadelphia 1884); Humphreys, H. H., ‘Major-General A. A. Humphreys’ United States Volunteers at Fredericksburg and Farmville, Va.’ (Chicago 1896); McClellan, C., ‘General A. A. Humphreys at Malvern Hill and Fredericksburg, Va.’ (Saint Paul 1888); Wilson, J. H., ‘Major-General A. A. Humphreys’ (in Military Historical Society of Massachusetts, Papers, Vol. X, p. 69, Boston 1895).

HUMPHREYS, David, American writer and diplomat: b. Derby, Conn., 10 July 1752; d. New Haven, 21 Feb. 1818. He was educated at Yale and graduated in 1771; after teaching for a few years he entered the army at the beginning of the Revolutionary War, serving as aide-de-camp to Generals Parsons and Putnam and in 1780 became a colonel and aide-de-camp to General Washington, who became his sincere friend and patron. In 1784 he went to Europe as secretary of the commission for negotiating treaties of commerce with foreign powers consisting of Jefferson, Franklin and Adams; in 1786 was elected to the legislature of Connecticut and was soon associated with the “Hartford Wits,” Hopkins, Trumbull and Barlow, in the composition of the ‘Anarchiad,’ a satirical poem of political conditions existing at that time. After Washington's first election he acted, more or less unofficially, as his private secretary. In 1789 he was appointed one of the three “commissioners for treating with Indians south of the Ohio.” In the following year he was sent to England, Portugal and Spain on a confidential diplomatic mission. He was Minister to Portugal 1791–97, Minister Plenipotentiary to Spain in 1797–1802. During his service in the diplomatic corps of the United States he concluded treaties with Tripoli and Algeria. On his return he imported from Spain 100 merino sheep, the first introduced into the United States, and engaged in the manufacture of woolens. In 1806 he erected a woolen mill in Derby, one of the first in this country and destined to become one of the most successful. That part of Derby which he developed industrially became known from then on as Humphreysville. He held command of the Connecticut militia in the War of 1812, and also served in the State legislature 1812–14. He held honorary degrees from Brown University and Dartmouth College, and was a Fellow of the Royal Society of London. Throughout his entire life he displayed great interest in and considerable ability for writing. Amongst his works the best known are ‘A Poem Addressed to the Armies of the United States of America’ (New Haven 1780); ‘The Glory of America’ (New Haven 1783); ‘A Poem on the Happiness of America’ (London 1786); ‘An Essay on the Life of the Hon. Major-General Israel Putnam’ (Hartford 1788); ‘A Poem on Industry’ (Philadelphia 1794); ‘The Yankey in England, a Drama in Five Acts’ (1815); ‘A Discourse on the Agriculture of the State of Connecticut, etc.’ (New Haven 1818). Various collections of his writings were published: ‘Poems’ (Philadelphia 1789); ‘The Miscellaneous Works of Colonel Humphreys’ (New York 1790); ‘The Miscellaneous Works of David Humphreys’ (New York 1804). Consult Cutting, N., ‘Journal of an Embassy to Algiers, 1793, under Col. David Humphreys’ (in *Dawson's Historical Magazine*, Vol. IV, pp. 262, 296, 359, New York 1860); Humphreys, F. W., ‘Life and Times of David Humphreys, etc.’ (2 vols., New York 1917); Marble, A. R., ‘David Humphreys and his Services to American Freedom and Industry’ (in *New England Magazine*, n. s. Vol. XXIX p. 690, Boston 1903–04); Orcutt, S., and Beardsley, A., ‘History of the Old Town of Derby, Conn., 1642–1880’ (Springfield, Mass., 1880); Swift, L., ‘Our Literary Diplomats’ (in *Book Buyer*, Vol. XX, p. 369, New York 1900).

HUMPHREYS, Frank Landon, American Protestant Episcopal clergyman and author: b. Auburn, N. Y., 16 June 1858. He was educated at Columbia and Oxford universities and attained the degrees of A.M., Mus.Doc., S.T.D. and LL.D. He was precentor and minister in charge of the cathedral of the Incarnation, Garden City, L. I., 1885–90, canon in the cathedral of Saint John the Divine, New York, 1900–06; chaplain of the Naval Order of United States Society of 1812 from 1895; historian of the Society of Colonial Wars; president of the Society of the Cincinnati in New Jersey; and vice-president of the Morristown Electric Light Company. Among his writings are ‘The Evolution of Church Music’ (1896); ‘Clerical Education’ (1896); ‘The Mystery of the Passion’ (1898); ‘Men of Understanding’ (1897); ‘Christmas Carols and Caroling’ (1900); ‘Beloved of Washington — Life of Col. David Humphreys’ (1904); and ‘What we owe to France’ (1915).

HUMPHREYS, Joshua, American shipbuilder: b. Haverford, Pa., 17 June 1751; d. there, 12 Jan. 1838. He came of Welsh Quaker stock, his grandfather, Daniel Humphreys, settling near Philadelphia in 1682. In 1765 he was apprenticed to a Philadelphia shipbuilder and, before reaching his majority, opened a shipyard of his own. He was the first builder of war vessels for the American colonists and is therefore often called the “father of the American navy.” As a result of his activities in behalf of the Revolution he was disowned by the Quakers. He was the first naval constructor of the United States navy. Among the ships constructed by him were the *Chesapeake*, *Congress*, *United States*, *President*, *Constellation* and the famous *Constitution*. Of these the *Constitution* is now at the Boston navy yard, the *Constellation* at Newport and the *President*, captured in 1814, during the war with England, at London. Consult Humphreys, H. H., 'Who built the First United States Navy?' (in *Pennsylvania Magazine of History and Biography*, Vol. XL, p. 385, Philadelphia 1916).

HUMPHREYS, Milton Wylie, American university professor and scholar: b. Greenbrier County, Va. (now W. Va.), 15 Sept. 1844. He served with distinction as a gunner in the Confederate army from 1862-65. After the Civil War he resumed his studies and took his master's degree at Washington and Lee University in 1869. In 1874 he received his Ph.D. at the University of Leipzig. He held the professorship of Greek at Vanderbilt University (1875-83); of classical languages at the University of Texas (1883-87), and then became professor of Greek at the University of Virginia, where he remained until his retirement in September 1912. Dr. Humphreys has been the chief American editor of the *Revue des Revues* (Paris 1878-88) and has edited independently the 'Clouds' of Aristophanes (1885); 'Antigone' of Sophocles (1891); and Demosthenes' 'On the Crown' (1913). He has contributed many erudite papers to both American and foreign journals.

HUMPHREYS, William Jackson, American physicist: b. Gap Mills, Monroe County, W. Va., 3 Feb. 1862. He received his education at Washington and Lee University and then pursued an engineering course at the University of Virginia; later specializing in physics and chemistry at Johns Hopkins. From 1889-93, he was professor of physics and mathematics at the Miller School, Virginia; from 1893-94 occupied the chair of physics and chemistry at Washington College, Maryland; and was instructor in physics at the University of Virginia (1897-1905). Since the last-named year he has been professor of meteorological physics of the United States Weather Bureau and occupied the same chair at George Washington University since 1911. Dr. Humphreys was director of the Research Station at Mount Weather, Va. (1905-08) and was a prominent member of the eclipse expedition to Sumatra under the auspices of the United States Naval Observatory. He has written numerous papers on electric phenomena.

HUMPHRY CLINKER. 'Humphry Clinker,' the last of Smollett's novels, was published in 1771, just before the author's death. It is the story of a Welsh gentleman named Matthew Bramble, a crusty bachelor who, suffering from gout and imaginary diseases, makes a tour of England and Scotland in order to be amused and to drink the waters at famous wells. He visits Bristol, Bath, London, Harrogate, Scarborough, Edinburgh, Glasgow and the Scottish lakes. Of his party are his sistter Tabitha, a mature spinster, with her maid Winifred Jenkins and her dog Chowder; his nephew Jeremiah Melford, a student fresh from Oxford, and his sentimental niece Lydia Melford. The novel takes its name from a footman picked up on the way between Bath and London, a shabby country lad who proves to have many accomplishments and the innate qualities of a gentleman. He becomes a Methodist preacher and converts the women of the company to the new doctrine of grace without works. The novel, written primarily to describe the sights and misadventures of a journey through the British Isles, has a sort of plot. Tabitha and Lydia both get husbands; and Humphry Clinker, made happy by the discovery that, though his mother was but a barmaid, his father was Matthew Bramble, is married to Winifred Jenkins. All return to Brambleton Hall in time for a Christmas dinner.

Thackeray rightly thought 'Humphry Clinker' the most laughable novel ever written. The farcical comedy, naturally rising out of the situation, is enhanced by a very clever use of letters which the travelers send to their friends at home, descriptive of the same incidents from the very different points of view of a hypochondriac, an aged spinster, a young woman in love, a young man of the world and a vivacious servant-maid. To Lydia, for example, the journey is a continuous round of delight; while nothing except Scotland gives the slightest pleasure to her uncle. All the scenes are based upon the direct observation of the author, who makes Matthew Bramble the mouthpiece of his own sardonic humor. In this gentleman more than anywhere else, Smollett embodied his own personality. He was generous, irritable, keenly intelligent, but thoroughly disillusioned. Perhaps the most amusing character is Lismahago, a soldier of fortune, who has been scalped and otherwise mutilated in Indian wars in America. To Tabitha he is "the prettiest gentleman" she has ever seen, and she marries him. With others besides Thackeray 'Humphry Clinker' has been a favorite. Lismahago, after undergoing a sea-change, reappears in Scott's Dalgetty; and from Smollett, Dickens learned the art of caricature. From the one passed to the other the humor to be derived from comic misspellings, unexpected turns of phrases and whimsical exaggeration. These characteristics in their extreme form appear in the letters of Winifred Jenkins, who writes from London to Mary Jones at Brambleton Hall: "I have seen the park, and the paleass of Saint Gimses, and the king's and the queen's magisterial pursing, and the sweet young princes and the hillyfents, and pye-bald ass, and all the rest of the royal family."

Wilbur L. Cross.

HUMUS, a term applied in the generic sense to the decomposed organic matter which makes up a certain percentage of soil matter. The carbon, nitrogen, oxygen and hydrogen are carried off in the process of decomposition in the form of water, carbon dioxide and ammonia, etc. The matter which remains is called humus. Chemical investigations of the compounds of which humus is composed have been unable to determine their exact nature and relations. However, the amount of humus in soil is an important factor in determining the degree of its fertility. See Soil.

HUN, Henry, American physician: b. Albany, N. Y., 1854. He received his education at the Sheffield Scientific School at Yale, where he was graduated in 1874. From 1874-75 he was assistant in physics there, and was graduated from the Harvard Medical School in 1879. He became professor of nervous diseases at the Albany Medical College (Union

University) and established a wide practice in that locality. Dr. Hun was president of the Association of American Physicians (1910) and president of the American Neurological Association (1913–14). He is author of 'Guide for American Medical Students in Europe' (1883); and 'Differential Diagnosis of the Diseases of the Nervous System' (1913).

HUNAN, hoo'nan, China, an inland province, bounded on the north by Hupeh, on the east by Kiangsi, on the south by Kwangsi and Kwangtung and on the west by Kweichau and Szechuan. The country is hilly, with considerable elevation in the south, southeast and along the western border. The chief rivers are the Siang, which rises in the Nan-shan and flows north into the Tung-t'ing Lake; the Tsze, which is only navigable for small boats; and the Yuen, which rises in the southeastern part of Kweichau and empties into Tung-t'ing Lake. The irrigation afforded by these streams and their tributaries makes the soil exceedingly fertile. It produces tea, hemp, rice and tobacco in large quantities. A considerable yield of lumber is produced annually. The coal mines cover a large part of the area of the southeastern part. Antimony ore, copper, tin and some precious metals are also mined. The chief cities are Siangtan, on the Siang River (Pop. about 400,000); Yochau, the «treaty port,» which is an important transportation point, having steamer connection with Hankau (Pop. 20,000); and Changte (Pop. 150,000), on the Yuen River. The capital is Changsha, on the Siang River, about 60 miles above Yochau. It is a fine city noted for its educational institutions, its wealth and culture. (Pop. 250,000). The people of Hunan are of an independent, healthy type; and for many years were entirely hostile to foreign intrusion. This spirit has been greatly minimized, however, in recent years. The most important railway is the Changsha-Chuchau, about 35 miles long, which is a branch of the Canton-Hankau line; but transportation is carried on principally by water. The area of Hunan is 83,330 square miles, and the population is estimated at 20,580,000.

HUNDRED, (1) in England and Ireland, a division of a county, or the body of residents and landholders therein. (2) In the United States, a political division similar to that in England and still surviving in Delaware. Hundreds in England were of varying sizes, but it is supposed to-day that originally they consisted of 100 families. Each hundred was presided over by a court, known as the Hundred Court. Until very recent times a hundred was held liable in England for damages resulting from various offenses, as rioting. Most of the hundred courts have been abolished, their jurisdiction having been acquired by the County Courts, but a few are in existence to-day.

HUNDRED DAYS (Fr. *Cent Jours*), the name applied to the period between 20 March 1815 and 28 June 1815—the time which intervened between Napoleon's return to Paris from Elba, and the restoration of Louis XVIII. The term became popular through its use by the Comte de Chambrol, prefect of Paris, in his speech of welcome to Louis. For the events of the Hundred Days, see NAPOLEON; FRANCE, *History*.

HUNDRED YEARS' WAR, the name given to the prolonged struggle between France and England which began in 1337 and ended in 1453. Among the chief of the immediate causes of the war was Edward III's claim to the French throne, but the keen rivalry of the two nations rendered conflict inevitable. It lasted during the reigns of five English kings, Edward III, Richard II, Henry IV, Henry V and Henry VI, and of five French kings, Philip VI, John II, Charles V, Charles VI and Charles VII, ending in the expulsion of the English from France. The most important events were: Defeat of French fleet at Sluys (1340); defeat of French at Creçy (1346); siege and capture of Calais (1347); defeat of English at Saint Omer (1352); defeat of French at Guines (1352); defeat of French and capture of John II at Poitiers (1356); Treaty of Brétigny (1360); defeat of English at Pontvallain (1370); defeat of English at Chizé (1373); truce of Bruges (1375); defeat of French at Agincourt (1415); Treaty of Troyes (1415); defeat of French at Verneuil (1424); siege of Orleans (1428); capture of Meaux and Paris (1429); defeat of English at Patay (1429); capture of Joan of Arc at Compiègne (1430); Joan of Arc burned at Rouen (1430); loss by English of Paris (1436), Nemours (1437), Meaux (1439), Mons (1448), Rouen (1449), Cherbourg (1450), Bordeaux (1453); defeat of English at Formigny (1450) and Castillon (1453); truce of Tours (1444). Besides the English and French kings mentioned, many of the most famous Frenchmen and Englishmen of the 14th and 15th centuries were active participants in these struggles: Edward, the Black Prince; Bertrand du Guesclin; Joan of Arc; John, Duke of Bedford; Arthur, Earl of Richmond; Dunois, Talbot, etc. Some of these events form the historical background for Shakespeare's 'Henry V,' and 'Henry VI.'

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1898); Puiseux, L., 'Siège et Prise de Rouen, etc.' (Caen 1866); id., 'Colonisation Anglaise en Normandie en XVme Siècle' (Caen 1867); Stevenson, J., 'Letters and Papers Relating to the Wars of the English in France' (London 1861–64); id., 'Narratives of the Expulsion of the English from Normandy, 1449–50' (London 1863); Tout, F. F., 'Political History of England, 1216–1377' (Vol. III, London 1905); Vaisette, D., 'Histoire Générale de Languedoc' (Paris 1885); Wrottesley, G., 'Crecy and Calais' (London 1897).

HUNEEUS, Jorge. See HUNNEUS, GEORGE.

HUNEKER, James Gibbons, American musical and dramatic critic: b. Philadelphia, 31 Jan. 1860. In Paris he was a pupil of Barili, Ritter and Dontreleau, and subsequently became an instructor in piano at the National Conservatory of New York. He was musical and dramatic critic of the New York *Recorder* in 1891–95, and of the *Morning Advertiser* in 1895–97. Subsequently he was musical editor, and from 1902 dramatic editor of the New York *Sun*. Among early writings which attracted wide attention are 'Mezzotints in Modern Music,' essays (1899); 'Chopin, as Man and Musician' (1900); an interesting study; 'Melomaniacs' (1902), clever but often extravagant stories satirizing the musical profession. His later works include 'Overtones' (1904); 'Iconoclasts' (1905); 'Visionaries' (1905); 'Egoists: A Book of Supermen' (1909); 'Franz Liszt' (1911); 'The Pathos of Distance' (1913); 'Ivory Apes and Peacocks' (1915); 'New Cosmopolis' (1915); 'Unicorns' (1917).

HUNG HSIU-CH'ÜAN, Chinese rebel: b. Hua, Kungtung, 1812; d. 1864. After a youth spent in desultory studies, including the doctrines of Christianity, he took up the occupation of a fortune-teller; and ere long joined the Society of God, organized by Chu Chiu-t'ao, of which he rose to be the head, one of his chief associates being Yang Hsiu-ch'ing. In 1836 he started, on the borders of Kuangtung and Kuangsi, a sect of professing Christians, and set to work to collect followers, styling himself the Brother of Christ. In July 1850 he headed a rising in the district of Kuei-p'ing, and made his way, plundering and ravaging, as far as Yung-an. He then adopted the term "Heavenly Dynasty of Perfect Peace" (*Taiping Kwoh*), styling himself the Heavenly King; and working his way northward in 1853, he captured Wu-ch'ang and all the other cities on the Yang-tsze down to An-ch'ing. On 11 March 1853 he took Nanking; and with that city as his headquarters he succeeded in capturing over 600 other cities in no less than 16 out of the 18 provinces. There he remained until 1864, when the Imperial forces under Tsêng Kuo-fan closed around him and the fall of the city was imminent. On 30 June, seeing that all was lost, he took poison, his body being subsequently found and burned. On 19 July Nanking was taken by assault, and one of the greatest rebellions the world has ever seen was at an end. From the fact that the T'ai-p'ings ceased to shave the head and wear a queue according to the Manchu fashion, they also came to be known as the Long-haired Rebels. Consult Brine, 'The Taiping Rebellion' (London 1862); and Lin-Li, 'Ti-ping Tien-Kwoh: History of the Taiping Revolution' (2 vols., London 1866).

HUNGARY (in Hungarian, Magyarország, "Land of the Magyars"); Germ., Ungarn; Fr., La Hongrie; Ital., Ungheria; Turk., Magyaristan; Latin, Hungaria: A country in the middle of the southern half of Europe, lying in the basin of the Danube. Until the break-up of the Austrian Empire in October 1918, the then kingdom of Hungary included Croatia-Slavonia, Dalmatia, Transylvania and the territory of Fiume (qq.v.). Hungary proper has an area of 109,188 square miles, with a population of 18,142,200 (1910 census). In form it resembles a semicircle, and except for a small portion of the western side, it is separated by natural boundaries on three sides from the neighboring territories. Encircled from the east round the north to the northwest by the long chain of the Carpathian Mountains for more than 1,000 miles, Hungary is bounded on the west by the river March and some offsets of the Noric Alps; on the southwest by the Drave; on the south and southeast by the Danube and the Transylvanian Alps — a continuation of the Carpathian range. Thus Hungary proper may be considered as a large basin surrounded by mountains on every side except the south; but even here the natural boundaries of this geographical basin are completed at no great distance from the frontier by the highlands of Croatia, Bosnia and Serbia, that meet those of Wallachia and Transylvania at the "Iron Gates," a pass formed by the abrupt divisions of the mountains on either side of the Danube, through which that river flows in whirling rapids. The immense curve of the Carpathians starts from the gate of the Danube near Pressburg, sweeps round one-half of the country from west, through north and east, to south, here it again reaches the Danube at the Iron Gates near Orsova. The only portion of the frontier not clearly outlined by nature is that marching with the Rumanian border, a line which, after negotiation with Rumania in 1887, was defined by the statute of 1888.

The mountains of Hungary belong to a dual system, the Carpathians being the greater and the Transylvania Alps the lesser range. The first group is the source of a multitude of streams which flow toward the south, forming long fertile valleys; the second group, less wild, but scarcely less beautiful, is rich in woodland scenery and is intersected by numerous passes. Between the Carpathians and the Alps lie the great Hungarian plains — the small and the greater Alföld. From Budapest (the capital) to the borders of Transylvania, from Tokay to Belgrade, stretches one vast alluvial plain, marshy in some places, parched in others, here and there loamy, but on the whole of extraordinary fertility. The Carpathian range is divided into three principal sections forming the northwestern, the northeastern and the southeastern highlands. The best known of the mountains is the High Tátra (*Magas Tátra*) in the north, which rises up in enormous proportions without any foothills at all to a height of 6,000 feet above the plain. On its southern slopes a series of watering places has been created, which attract numerous visitors both in summer and winter. The loftiest peaks are those of Lomnicz, over 8,600 feet high, and

Gerlachfalva (now called Ferencz József), 8,737 feet — the highest mountain in Hungary. The most extensive members of the Carpathian system are the southeastern highlands, abounding in wondrously beautiful spots and forming a grand natural fortress through which there run but few passes. The Vereczke Pass, in the northeastern frontier range, is famous in history as that by which the Magyars entered the country in 898 A.D. All the mountains of Hungary do not belong to the Carpathian system, for three branches of the Alps enter Hungarian territory on the west. One of these stretches along the shores of the Adriatic; a second extends east between the Save and the Drave; while the third flanks the long frontier line of the country between the Drave and the Danube, and after being intersected by the valleys of rivers and being reduced in many places to low-lying hills, ends at the Danube near Budapest in a low mountain range of over 2,000 feet in height, named the Bakony Wald. This branch of the Alps stretching towards the east, near Visegrád faces the spurs of the Carpathians, which also extends right down to the Danube where the mighty stream is enclosed by wooded mountains, constituting a magnificent panorama.

The Little Hungarian Plain (Kis-Alföld) lies in the western part of the country upon the islands and both sides of the Danube from Pressburg (Pozsony) to Gran (Esztergom); it is exceedingly fertile and has an area of about 5,000 square miles. Coming through the passes of the Danube at Vácz from the small plain, we reach the Great Hungarian Plain, lying in the centre of the land and bounded by the Carpathians on one side and the lower Danube on the other, occupying some 30,000 square miles. Its greatest length is traversed by the river Tisza (Theiss). The undulating surface is covered with salt marshes, sand-dunes and rows of mounds. During recent years much of the monotony of the territory has been lessened by cultivation; great pastures and luxuriant meadows have been broken by fine forests and orchards; broad roads and railways intersect the former lonely tracts, and the immense pasture-grounds are filled with cattle, horses, sheep and swine. The villages are large and populous, but are generally long distances apart.

Hydrography.— The Danube (Duna) is the principal waterway of Hungary, and most of the rivers belong to it. Only two streams rising in the High Tátra flow to the Vistula. Traversing the country for nearly 600 miles, the Danube contains several large islands, the principal ones being Csallóköz and Szigetköz between Pressburg and Komorn; above Budapest lies the island of Szent Endre and below that of Csepel. The Danube is navigable by steamships from Vienna to the Black Sea. Tributary streams of the Danube on the left side are the Morva, Vág, Garam, Ipoly, Tisza and Temes; on the right the Lajta (or Leitha), Rába, Kapos, Drave and Save. The Mura flows into the Drave. The Tisza rises and ends in the country. Four silver stripes in the Hungarian coat-of-arms represent the Danube, the Tisza, the Save and the Drave. The two largest lakes in Hungary are the Balaton or Plattensee and the Fertö or Neusiedler See. Both lie in that part of the country which extends along the right bank of the Danube, the Pannonia of the Romans. Balaton is 46 miles long from N.E. to S.W., has an area of 230 square miles and stands 420 feet above sea-level. Its banks are flanked by watering-places and the surrounding hills covered with rich vineyards. Fertö Lake has an area of 110 square miles and its surface — which is not permanent — is 370 feet above sea-level. Although many canals have been projected in Hungary, there are few in actual existence; the Ferencz Canal between the Danube and the Tisza, and the canal at the Iron Gates, both old constructions, are still the most important.

Climate.— Though the whole territory of Hungary is situated within 44° and 49° (latitude) North, i.e., within the temperate zone, yet there are great divergencies between the various parts of the country in respect of mean, minimum and maximum temperature. The winter is in general very cold, especially in the great plain and in the inner basin of Transylvania; the summer is hotter than in western Europe in the same latitude. The average temperature ranges between 42° and 58° F. The average monthly temperature in January falls to 40° and 42° F. In January the temperature is highest in the western half of the country and lowers gradually toward the east. In July, on the other hand, it is highest where Hungarian territory approaches the Adriatic, and in the district between the southern frontier and the centre of the country on both banks of the Tisza. The climate is very variable in the highlands, but snow does not lie in summer, except in some hollows of the High Tátra. The rainfall varies considerably in different parts. At the foot of the northwestern Carpathians the annual average is 59 inches; in the mountainous Karst district near the Adriatic the average is about 79 inches; whereas in the Small Hungarian Lowlands it is only 20 inches and in the Great Hungarian Lowlands about 25 inches. Spring is the cloudy season; in the summer the *délibáb*, or Fata Morgana, rises about noon on warm, tranquil days and spreads like a shimmering sea over the heated plain. Despite its climatic variability Hungary is one of the healthiest countries in Europe.

Natural Resources.— While most of the soil of Hungary is productive, more than half is arable land. The Carpathians present many varied physical features of geological structure. The wild granite rocks of the Tátra exhibit scenes of savage grandeur and stand out in sharp contrast to the broad flat sandstone ridges of the Carpathian Waldgebirge. The whole region of the north Hungarian mountains between the upper part of the Tisza and the Danube is noted for its mineral wealth, which has been worked from very early times. The northern counties of Szepes (Zips) and Gömör, to the southeast of the Tátra, abound in iron ores. Kassau (Kaschau), to the east, is the largest town in northern Hungary and the centre of a district containing metals and the only opal mines in Europe. To the southwest, in the basin of the Gran, lie Schemnitz and Kremnitz, noted for the production of the precious metals, especially silver. Lignite is mined among Tertiary rocks in several of the valleys. Salt abounds in the valley of the upper Tisza. The mountains of Transylvania produce gold; varying quantities of silver, copper, mercury, zinc, nickel and lead are also found, and much salt. Other parts yield coal, petroleum, cobalt, antimony, sulphur, soda, salpetre, alum, vitriol, arsenic, marble, peat and remarkably fine chalcedony. The alluvial and diluvial deposits in the plains form excellent soil for wheat, rye, barley and maize, of which large quantities are exported. Most of the mountainous districts are covered with forests; the woods occupy 30 per cent of their area, as against from 1 to 5 per cent of the plains. There is a valuable export trade in timber, principally oak, poplar and acacia. Fruit trees are widely cultivated and much fruit is exported, while the wine production is of great magnitude. The most celebrated wine is made in the Tokay district, and that which goes by the name of Carlowitz is well known. Vineyards cover more than 30,000 square miles. The great moors and forests provide ample game for the sportsman, the bear, wolf, lynx, wild cat and boar still roam, as well as stags and chamois. The vulture and the eagle soar above. The Danube and the Tisza abound in wild fowl, and the plains are plentifully stocked with hares and partridges. No other European country rivals Hungary in the wild and profuse luxuriance of fauna and flora. Vines, maize, almonds, figs, olives and apples flourish in abundance. Hungary is also endowed with a wealth of medicinal waters. Cold mineral and thermal springs are to be found almost everywhere. Budapest is rich in medicinal springs, and a whole series of hot springs containing lime and sulphur rise out of the volcanic hills on the right bank of the Danube. Sulphuric hot springs of remarkable healing properties for the treatment of rheumatism, gout and diseases of the bones are plentiful. There are 38 important watering places with hot springs in the country and 52 climatic health resorts. The famous medicinal water called Húnyadi János is exported to all parts of the world.

Ethnography and Population.— Like Austria and Russia, Hungary is a polyglot country of many races whose unity is merely political. Exact statistics are not obtainable, since for many years the census returns have been deliberately falsified for «Magyar State» reasons —to prove that the Magyars are the predominant race in numbers as well as in political power. Competent observers estimate that, in Hungary proper — excluding Croatia-Slavonia, the new Jugo-Slav state — there are about 8,500,000 Magyars, or over 1,500,000 less than the official figures show. Some authorities even place the number of Magyars as low as seven to eight millions. Of these classified as «Magyars» there are nearly 1,000,000 professing and a large number of baptized Jews. Against this total there are more than 2,000,000 Germans, including the numerous colonies on the Austrian border, the Swabians of the south and the Saxons of Transylvania; more than 2,000,000 Slovaks, inhabiting chiefly the northwestern counties; between three and four million Rumanes, living between the Tisza and the eastern Carpathians; some 500,000 Ruthenes or little Russians, who inhabit the northeastern counties; some 600,000 Serbs and Croats in the central southern counties; 100,000 Slovenes along the borders of Styria and Carinthia; and some 200,000 other non-Magyars, including about 90,000 gypsies, who speak a language of their own. Taking the population of Hungary proper at 18,000,000, the Magyars are thus in a minority, which becomes more marked when the former (till 1918) crown-land of Croatia-Slavonia are added, with its population of 2,600,000 Southern Slavs. In 1868 Croatian was recognized by law as the official language of these crown-lands; it has since proved to be the mother-tongue of over 60 per cent of the inhabitants. The last census returns (1910) for Hungary show that there were 11,820,416 persons speaking the Hungarian language, or 64.7 per cent. Obviously, a great number would naturally speak the official language of the country without being of Magyar birth. The census also showed 278,130 foreign residents of whom 235,475 were Austrians; 8,655, Germans; 10,612, Italians; 5,640, from Bosnia and Herzegovina; 1,055, French; 2,389, Russians; 998, Swiss; 1,042, British; 1,674, Turks, and 10,590 of other nationalities. The town population of Hungary was close to 4,000,000. In 1913, the last normal year before the war, there were 751,517 births and 500,875 deaths; the rate of illegitimacy was 9.2 of the total number of births. Marriages, 195,030. The infant death rate is remarkably high. The Magyars (pron. mäd'yär), who are the dominant race, are located for the most part in the centre of the country. They are high-spirited, proud, warlike and generous; according to travelers they are more sincere than their Serbian and Wallachian (Rumanian) neighbors. Their general deportment is serious; and in many respects they resemble the Turks, who followed them out of Asia, and belong to the same great family of mankind. The Magyar costume is remarkable for its picturesque elegance. Most of the Hungarian nobles are Magyars; and it is by this section of the population that the constitutional form of government and municipal institutions have been mainly, if not wholly, upheld. The Slovaks are among the people apparently the earliest settled in Hungary; they inhabit the northwest, and are similar in race, customs and language to the adjacent Moravians, to whose extensive empire they belonged before the Magyar conquest. The Ruthenians or Rusniaks dwell beneath the north and northeastern Carpathians. The Rumanians (Wallachians) occupy a tolerably wide tract of country on both sides of the west and north boundaries of Transylvania. They are behind the Slovaks, and, indeed, nearly all the other races of Hungary, in education and civilization. They appear to be the descendants of Italian colonists, placed in Dacia during the Roman dominion there, and have been accordingly called Daco-Romans — an epithet to which their classic features, easy manners, language and antique costume seem to give them a claim. They call themselves *Romouni*; and speak a dialect of Latin. The Croats people nearly all Slavonia and Croatia, and stretch into seven of the counties of Hungary proper as far as the county of Pesth. The Wends (Vandals) inhabit two counties of Hungary proper as far as the county Theresianopel, and a few other parts of the Banat; the Montenegrins a part of the county Temes; and the Armenians portions of three of the eastern counties. The Germans appear, in the first instance, to have emigrated into the country during or before the 7th century, subsequently to which many successive immigrations took place, especially under Geysa, king of Hungary, who ascended the throne 1141 A.D. and who established large numbers of German colonists from Franconia, Thuringia and Alsace in several of the northern counties, and in Transylvania. They speedily became dispersed in detached settlements over all Hungary; and early in the 13th century Pesth was described as a «large and rich German town.» In the 18th century other Teutonic immigrants, with some French refugees, settled in the kingdom. They people the greater part of the western frontier, from Pressburg and around the shores of Lake Neusiedler south nearly to the limit of Croatia; elsewhere they are most numerous in the county of Zips, the mining districts, the Banat, and especially in the towns, where they compose the bulk of the trading population. Class animosity is exceedingly strong among the mixture of races. The Magyar peasant never forgets the dominance of his race and treats the peasants of other nationalities with more or less good-natured insolence. He especially despises Jews and gypsies.

According to the last census Budapest, the capital, a magnificent double city, also called Pest-Ofen or Buda-Pest, and situated on both sides of the Danube, had a population of 880,371. The only other town with a population of over 100,000 was Szeged, 118,328. The towns of Transylvania present a striking contrast to the cities of the plains. They are full of picturesque reminiscences of the Middle Ages. Some of the true Hungarian cities spread over the Alföld have enormous areas with small populations. Debreczen, for instance, is larger than New York city in area and has only 93,000 inhabitants. Country life is monotonous and dull; the ablest men are attracted to the cities, and little is left to the villagers beyond «the call to work at dawn and the church bells in the evening.» There was no absolute ownership of land except in the hands of the crown; so long as a member of a family lived, the property remained in his hands, otherwise it devolved upon the king, who could vest it only in a noble family.

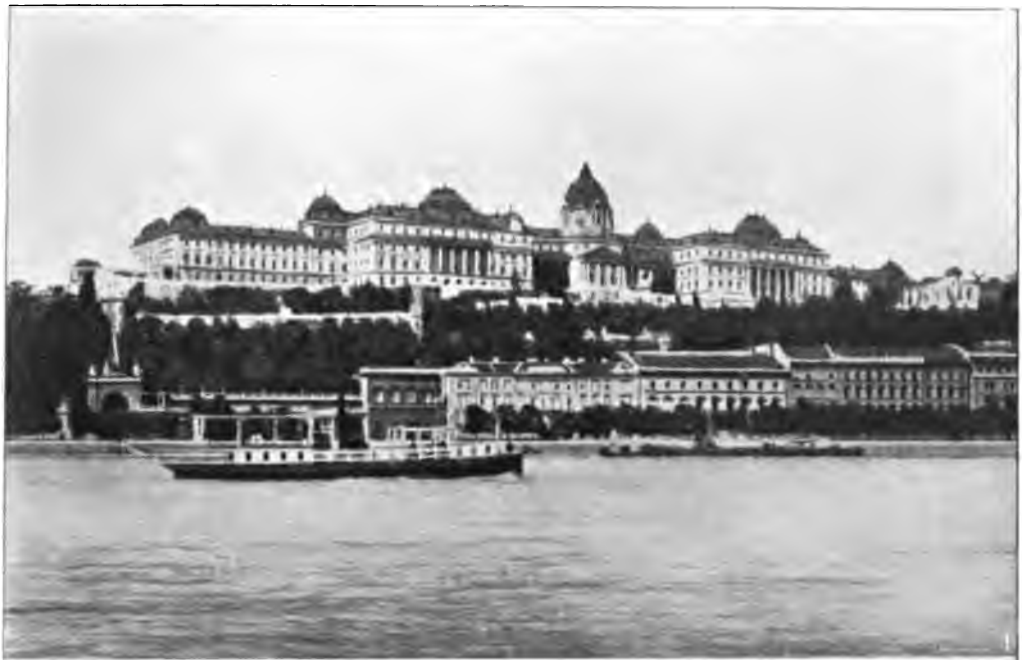
Emigration.— As most of the peasantry live in grinding poverty, large numbers who are able to do so emigrate to other countries, principally to the United States. In 1911 the United States admitted 19,996 Magyars, 18,982 Croats and Slavonians, and 21,415 Slovaks; in 1912 there were 23,599 Magyars, 24,366 Croats and Slavonians and 25,281 Slovaks; in the year before the war broke out the numbers rose to 30,610 Magyars, 42,499 Croats and Slavonians and 27,234 Slovaks. For the year ending June 1917, after the United States had been three months at war, only 112 immigrants were admitted from Hungary.

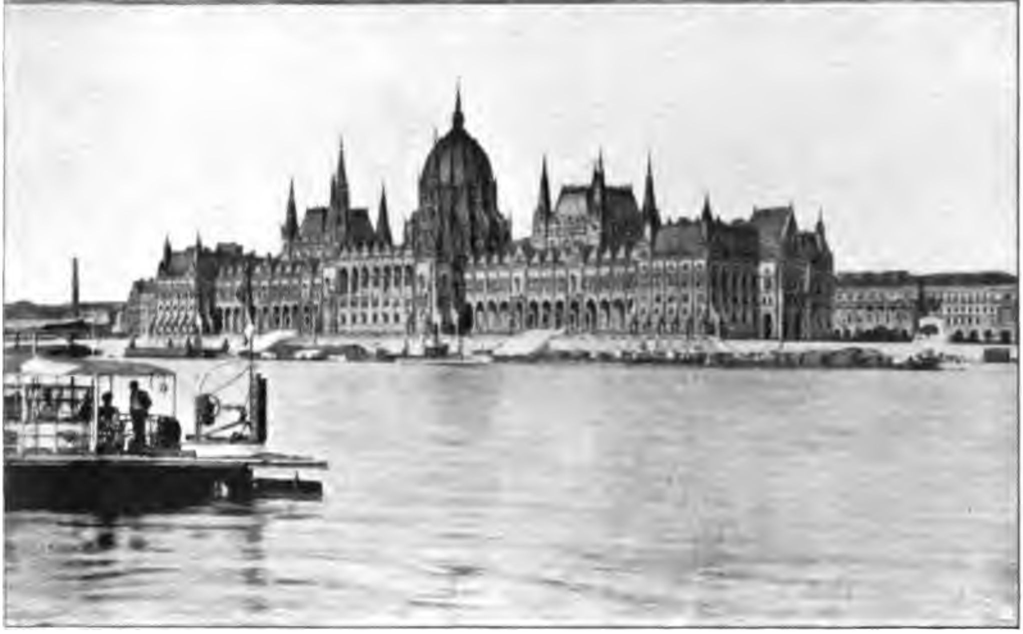
Agriculture, Live Stock and Trade.— Almost the only industry in Hungary is agriculture, which provides a living for nearly 70 per cent of the population. Directly or indirectly agriculture supports nearly three-fourths of the inhabitants. Of the total area of arable land no less than 82.09 per cent is farmed by the proprietors, and only 17.91 by tenants. Stock-breeding was the chief industry for centuries, but agriculture has become increasingly important during the last 70 years. The great plains are dotted with agricultural villages separated by long solitary tracts. The principal products of Hungarian agriculture are wheat, rye, barley, oats, maize, potatoes, clover and lucerne, rape-seed, peas, lentils, hemp, flax, tobacco, sugar-beet, vegetables and rice. Nearly all the corn is consumed in Hungary and Austria; only the finest flour is exported. The great pride of Hungarian agriculture, however, is Hungarian wine, for which one of the best foreign markets is, strange to say, Bordeaux. The industry is so disfigured by a wide system of adulteration that a bottle of genuine Hungarian wine, it is admitted by natives, rarely leaves the country. A kind of brandy called Slivovitz is prepared from plums. Horses, cattle, sheep, hogs, game (in the north bears), poultry, fish (among which the sturgeon and salmon are the principal), bees and silkworms are among the productions of the animal kingdom. Long hours and small pay mark the lives of agricultural laborers, causing much discontent and friction. Government intervention and numerous acts of Parliament have vainly endeavored to check the flow of emigration by improving the lot of the workers.

The principal artisans are tanners, furriers, manufacturers of *tschism* (cordovan boots), lace-makers, harness-makers, makers of wooden wares, of straw-plait work, etc. There are few extensive manufactures in Hungary. There are numerous iron and steel works, some iron-foundries, tinplate and wire works; also potteries, glass manufactures, sugar-refineries and beet-root sugar works, soap-works, tallow, stearine and wax-candle works; soda, saltpetre and potash works and brandy distilleries. Trade is almost exclusively in the hands of the Germans, Greeks and Jews. Internal commerce is promoted by the railways and rivers, the Temes and Francis canals (the former 75, the latter 60½ miles long), the fairs (which amount to 2,000), and the complete absence of tolls. The railways have a total length of about 13,400 miles, 11,665 miles being run by the state, and the remainder by private companies. The total length of navigable rivers and canals is 3,736 miles, of which 2,177 miles are navigable for steamers. The Danube is the most important highway of traffic. Before the war Hungary possessed about 540 merchant ships, steam and sail.

Government.— The Hungarian constitution and the system of central government obtaining in Hungary under the old régime which ended in 1918 are dealt with in the article AUSTRIA. Of that famous constitution it may be said that the practical application of its principles was not in strict accordance with its written provisions. Although, on paper, Magyars and non-Magyars were on terms of equality before the law and nominally fully represented in the legislature, the fact was that the representatives rather represented the Magyar upper classes than the subject nationalities or the masses of the people. Only a quarter of the men qualified to vote were permitted to exercise that power, being disfranchised by various questionable means besides property qualifications. As the Germans in Austria, so the Magyars in Hungary were in the minority, hence the manipulation of the census returns referred to under *Population*. The Dual Settlement after the Austrian defeat at Sadowa had the effect of making the German minority supreme in Austria and the Magyar minority supreme in Hungary, a circumstance, by the way, which ren-

HUNGARY



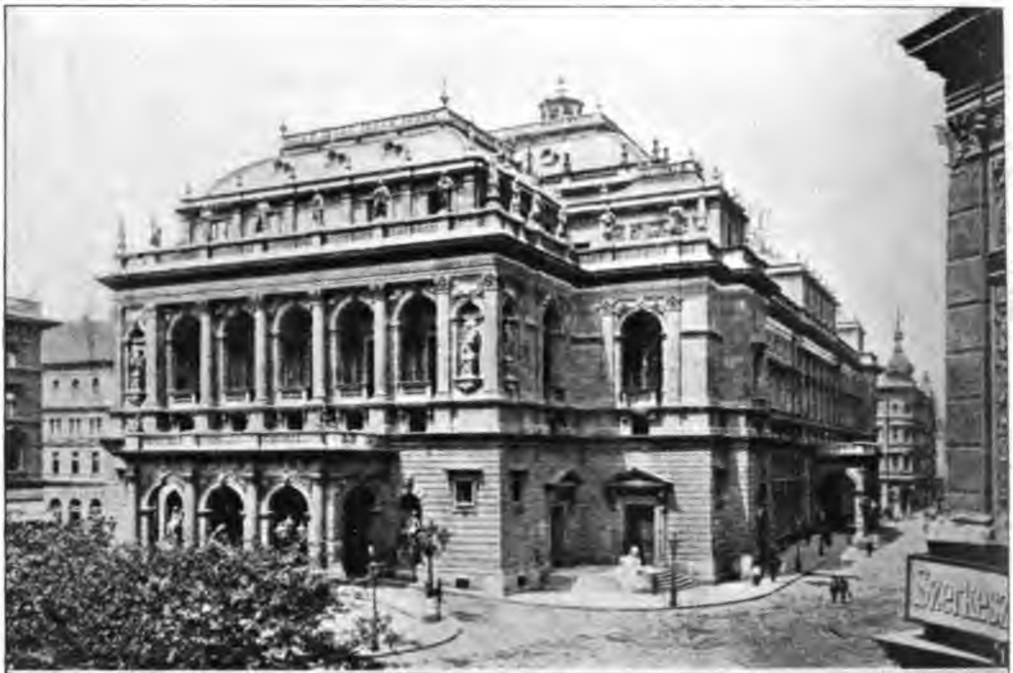


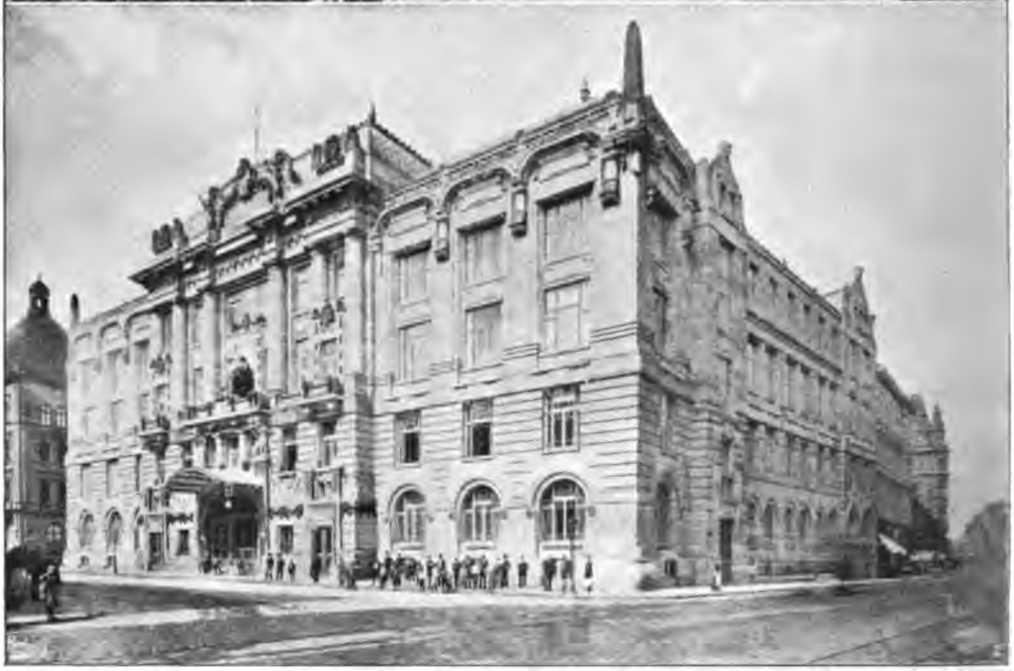
Photographs by Divald

1 The Royal Palace, Budapest

2 Houses of Parliament, Budapest

HUNGARY





Photographs by (1) Divald; (2) Erdelyi

1 Royal Opera House, Budapest

2 Academy of Music, Budapest

dered both minorities dependent upon Prussian support as against the Slav majorities. The remarkable disparity between population and the numbers of the 413 deputies for Hungary alone in the last election preceding the war is shown by the returns of 1910: Magyars, Independents and other parties, 404; Socialists, 1; Rumanians, 5; Slovaks, 3; Serbs, none. About 400 of these were Magyars; the remaining 13 represented nearly 10,000,000 non-Magyars, out of a total population of, roughly, 18,000,000. Elections were invariably accompanied by bloodshed, violence and terrorism. For the 1910 elections no fewer than 202 battalions of infantry were mobilized, besides 126 squadrons of cavalry, while a large number of troops were brought in from Austria. The price of "maintaining order" was estimated at nearly $4,000,000 (*Danzer's Armeezeitung*, 6 June 1910). Troops and gendarmes prevented many thousands of qualified voters from entering polling booths in the country districts. During one election 32 men were killed and 70 wounded. An electoral reform bill in 1918 enfranchised every male Hungarian over 24 possessing any one of the following qualifications: Two years' service in the war; non-commissioned rank; passed primary education; payment of annual tax ($2); having a licensed profession or trade; permanently employed; being a former elector. The ability to read and write is attached to each qualification. On 1 Nov. 1918 Count Karolyi announced that following a revolution in Budapest a Hungarian National Council had taken over the government. The king-emperor formally abdicated on 11 Nov. 1918. Thus ended nearly 400 years of revolt against Hapsburg rule.

Local Government in Hungary was administered since 1876 by committees partly elected by the county or district and partly appointed by the crown. A more bureaucratic system was introduced in 1891. The local assemblies are now half composed of landed proprietors and half of those chosen by parliamentary electors, presided over by the appointed lord-lieutenant. There is no popular representation in the true sense in these county assemblies. The landowners and those elected under the very limited parliamentary franchise hold all the power, while the working classes and subject races have none whatever. So far from being — as it was often held up to be — the land of ideal local government, "Hungary is becoming the happy hunting ground of the *petite bourgeoisie*, which, with its strong Jewish element, is replacing the decaying gentry of former days."

Law and Justice.— The Minister of Justice stands at the head of judicial affairs and exercises only administrative control. His functions, prescribed by law, relate to the supervision of judges, legal redress in international law, extradition, the execution of punishments, pardons, dispensation in divorce cases, and especially the preparation of bills. The judges were appointed by the king; they were perfectly independent and irremovable. As courts of first instance there are — in Hungary proper — 385 district courts with single judges and 67 county courts with collegiate judgeships. Altogether there are over 2,000 judges of first instance. As superior courts there were the 11 "Royal Tables" (Courts of Appeal) and the Curia (High Court of Justice) in Budapest, the first composed of 200 judges, the latter of 92. Civil procedure is regulated by the Consolidation Acts of 1868 and 1881; summary procedure was codified in 1893. The Criminal Code of 1896 closely resembles the English model.

Religion.— The creeds of the Hungarian peoples are as various as the races: Roman Catholic, Greek Catholic, Old Catholic, Greek Oriental or Orthodox, Evangelical, Unitarian, Evangelical Brotherhood, Baptist, Gregorian — Armenian, Jewish and Mohammedan. All are recognized and each sect independently administers its own affairs; on the whole this principle is loyally respected. The education act of 1907 somewhat restricted that autonomy in regard to the Church schools. The latest statistics, which include Croatia-Slavonia, now separated from Hungary, give the religions as follows:

Roman Catholics	10,888,138
Greek Catholics	2,025,508
Evangelical	3,961,472
Greek Orthodox	2,987,163
Unitarians	74,296
Jews	932,458
Others	17,452
Total	20,886,487

It is somewhat remarkable that the true Magyars, in spite of having become Christians, still preserve to this day the original pagan expression, *The God of the Hungarians.*

Education.— Since 1868 all children between the ages of 6 and 12 are supposed to attend day schools. Children that are educated privately or at home must pass a public examination at the end of the year. Three years (12 to 15) must be spent in continuation schools. In 1910 there were over 9,000,000 who could neither read nor write — nearly half the population, while 1,775,000 could only read. Continuation schools for technical instruction in agriculture gradually took the place of general continuation courses all over the country and give both theoretical and practical instruction, the latter on model farms and gardens attached to the schools, which are separately for boys and girls. Since 1907 Magyar is the language used in all continuation schools. About 2,754,000 children attend elementary day schools, to the upkeep of which the local authorities defray 71 per cent of the cost; the state contributes the rest. Higher education is provided by secondary schools wherein pupils are prepared for college and university. There are two kinds of secondary schools — the *gymnasia* or classical schools, which attach most importance to the humanities, to the classical languages, history and literature; and the *realschulen*, which, by putting modern languages, mathematics and natural science in the foreground, prepare their pupils for the higher grades of technical science. The latest figures show 192 *gymnasia* with 66,863 pupils and 43 *realschulen* with 14,938 pupils. The Magyar element predominates in all the higher schools. In a few of these the German, Italian, Serbian or Rumanian languages are used. In Hungary proper there are some 60 institutions of university status; 2 universities of sciences, 1 of technical sciences, 10 law academies and 47 theological colleges. The state maintains 5 universities: Budapest, Kolozsvár, Agram, Pressburg and Debreczen. All but one comprise the four faculties of medicine, law, philosophy and theology. Women are admitted to the universities as ordinary students. The theological colleges are thus distributed: Roman Catholic, 29; Greek Catholic, 4; Greek Oriental, 4; Protestant, 9; Jewish, 1. A large number of Hungarian students go agroad to study at foreign universities. Before the war Hungary possessed over 1,000 institutions for instruction in agriculture, commerce, industries, technology, mining, art, music and military training. The Hungarian National Museum (founded 1802) in Budapest contains a library of over 1,500,000 volumes and a rich collection of antiquities, natural history and ethnographical exhibits, and the oldest monuments of Hungarian life, language, literature and history. Among other museums, that of Fine Arts contains numerous old masters and the works of modern painters.

Language.— Hungarian (properly Magyar) is a branch of the Ural-Altaic family of languages to which belong the Samoyede, Mongolian, Tungusian, Turco-Tartaric and Finno-Ugrian languages. It is classed in the Ugric branch of the northern division of the Turanian group and is most closely allied to the Ostiak, Vogulic and Mordvinic, and is also akin to the Turkish. Together with Finnish and Turkish it is one of the three non-Aryan languages that have taken root in Europe. The language of the Huns (from whom the name of Hungary is derived) is not known; neither do we know when they first appeared in Europe. They were conquered by the invading Magyars toward the end ot the 9th century. Magyar differs from all the cultivated languages of Europe in internal structure and external form and is difficult to learn. Its origin has been the subject of much speculation; philologists have sought its cradle in the Hebrew, Turkish and Slavonic tongues. An Hungarian monk in the 13th century found a tribe called the Baskirs on the banks of the Kama in eastern Russia who spoke Magyar. An Hungarian astronomer visited the extreme northern coast of Norway in 1769 to observe the transit of Venus when he found that he was able to understand the Laplanders, which led him to write a book entitled 'Demonstratio Idioma Ungarorum et Lapponum idem esse,' a work that proved the origin of Magyar. But Leibnitz, who died half-a-century before, had already propounded a theory that the Finns, Lapps and Hungarians were related.

At the dawn of the 19th century Latin was the language of the scholar and the native tongue was held in disfavor. At that time the language of the people was inadequate to express the new ideas. A national movement began to stimulate literature, invent new words, and to substitute Magyar for Latin as the literary and political language of the country. By 1830 some 7,000 new words had been coined and added to the language; others have been added since, while not a few were borrowed from German and Slavonic languages.

Magyar is written in Latin letters (no *W*); by a system of accents, umlauts and combinations, 15 vowels and 26 consonantal characters represent every sound in the language with invariable fidelity. As in the other Turanian languages the root is never obscured in words, whatever changes they undergo. Determining or modifying syllables are placed at the end, and have a double form, always taking a different vowel when attached to a sharp-vowel root from what they have when attached to a flat-vowel root — a general characteristic of the Turanian languages. These suffixes represent the case-endings of nouns and the conjugations of verbs in other languages, and are very numerous. Hungarian has no diphthongs nor gutturals. At the beginning of a syllable the Hungarian never allows more than one consonant; in foreign words which begin with two consonants, the consonants are made to go with different syllables by putting a vowel before them (for example, of *schola* they make *iskola*), or a vowel is put between (as from *král* they make *király*). It also has no distinction of sex whatever. No vowel is mute. Family names are considered as adjectives, from which they mostly originated, and hence are put before the baptismal name; for instance, Bátori Gábor (Gabriel Bátori), as if it were the Batorish Gabor, the Gabor of the Batori family. The perfect proportion between vowels and consonants, the accurate shadowing and full articulation which every syllable requires, and the fixed succession of vowels, give to the language a character of masculine harmony. The tonic accent or stress is always on the first syllable.

The preference given to Latin over the national language, not only in the Church, but in judical proceedings, legal documents and parliamentary debates prevailed until 1844. The use of a dead language in common life, as well as in all scientific subjects, could neither be advantageous to the general improvement of the people nor to the national literature. Though with the introduction of Christianity into Hungary the Latin language acquired the ascendency in the Church, in schools, in public affairs, parliament and courts, yet Magyar was used in commerce, in the streets and in camp, and even the resolutions of the diet were first drawn up in it and then translated into Latin. After a struggle which had continued almost without interruption since 1790, the Magyar language was raised (1844) to the position to which it was entitled as that of a dominant nation.

Literature.— It is said that nationality is to the Hungarians a question of more absorbing interest than religion, and the truth of this assertion is reflected in almost every phase of their literature. Already their earliest poetical myths reveal the influence of national politics. Though the Magyars under Arpád conquered the Huns and their territory, they nevertheless adopted the Hun king, Attila, as their own ancestor and a national hero. Their own legends and traditions are interwoven with those of the Huns and form part of 'The Legend of the Occupation of the Fatherland,' the second great cycle of primitive Hungarian poetry. After its conversion to Christianity (about the year 1000) under king Saint Stephen, churches, monasteries and schools sprang up in Hungary, but the earliest written memorial of the language dates from the beginning of the 13th century, in the shape of a short funeral address. Of the two mighty forces that dominated the literature of Christendom during the Middle Ages — religion and the spirit of chivalry — only one, religion, is represented in the relics of Hungarian literature that have survived. Traditional sagas and prose legends inscribed on parchment still exist to bear witness to a high standard of literary culture at Hungarian courts and among the nobles and ecclesiastics during the 14th and 15th centuries. Earlier manuscript books exist containing legends of Saint Francis of Assissi; other documents retail legends clustering around the national saints, the Arpád kings, and especially Stephen.

In 1465 Janus Pannonius wrote an Hungarian grammar, which is lost. The 16th century was favorable to Hungarian literature, through the religious disputes in the country, the sacred, martial and popular songs, as well as by the histories written and published for the people, and the multiplied translations of the Bible. Among writers of ballads or metrical tales belonging to the 16th century may be mentioned Tinódi, Kákonyi, Tsanádi, Valkai, Tserényi, Szegedi, Illésfalvi, Fazékas, Balassa, etc. A higher aim was manifested by the epic poems of Count Niklas Zrinyi (1652), Ladislaus Lissthi (1653), Christopher Paskó (1663), Count Stephen Koháry (1699), and in particular the numerous and excellent productions of Stephen von Gyöngyösi (1664–1734), as well as the lyric poems of Rimai, Balassa, Benitzky, etc. In 1653 an encyclopædia of all the sciences, and in 1656 a work on logic, were drawn up in the Hungarian language by John Tsere (Apátzai). A large number of grammars and dictionaries were printed from the 16th century to the 18th. But the hopes of the further development of Hungarian literature were not realized; a Latin period again succeeded, from 1700 to 1780, during which time numerous and finished works were composed in Latin by Hungarian writers. In 1721 a Latin newspaper was established, and the state calendar, which commenced in 1726, was regularly published in Latin. In 1781 the first Hungarian newspaper was printed in Pressburg.

After Joseph II died (1790) several laws were passed in favor of the Hungarian language. Several periodicals were established, Hungarian theatres erected in Buda and Pesth, many works were written both in poetry and prose. The modern period of Hungarian literature may be said to date from the time of Joseph II. The epic poem of Arpád was written by Andrew Horváth, and published at Pesth in 1830. The brothers Alexander and Charles Kisfaludy acquired a great and deserved reputation as poets and dramatists, and did much toward developing the national language and literature. The latter (who died in 1830) may be looked upon as the founder of the modern drama in Hungary. The most celebrated works of the former are his lyrical masterpiece, 'Himfy Szerelmei' (Himfy's Love, 1802), his 'Regék a Magyar elöidöböl' (Tales of the Early Hungarian Times), and his historical tragedies, which were partly modeled on those of Schiller. The development of the Hungarian literature owes much to the influence of the periodical press, which spread abroad a taste for literature at the same time as it intensified the sentiment of nationality among the people. In this department the name of Kossuth deserves honorable mention. Previous to the troubles of 1848–49, which checked for a time the national growth of the literature, almost every species of composition was successfully practised. Works on politics and narratives of travel were written by Eötvös, Széchenyi, Szalay, Szemere, etc.; on history by Stephen and Michael Horváth, Szalay and Jaszay; on philology by Fogarassy and Bloch; works on the exact sciences, however, were confined to translations from the German, French and English. Novels and romances were written by Baron Jósika, Eötvös, Kemény, Kuthy, Nagy, Pálffy, etc., which, though of no great originality, showed considerable artistic skill, and helped to diffuse a more correct style. The dramatic pieces of Eötvös, Obernyik, Vörösmarty, and the prolific Szigligeti — who for a long time had almost the exclusive possession of the national stage — have greater value and originality. It is in poetry, strictly so called, however, that modern Hungarian literature shines. Many of the poems (songs, ballads, etc.) of Czuczor, Vörösmarty, Bajza, Garay, Bachot, Szász, Erdélyi, Kerény and others, are among the finest things that modern literature has produced. In this field the palm must be awarded to Alexander Petöfi, who completely freed Hungarian poetry from its dependence on foreign models and subjects, and inspired it with a life drawn fresh from nature and national feeling; and who, in artistic skill and masterly handling of his mother tongue, ranks as a model. Tompa, Hiador, Lisznyai and others, have copied him with more or less success. The collection of ancient Hungarian national poetry, compiled and edited by John Erdélyi, at the instance of the Kisfaludy Society (three vols., Pesth 1845–47), contributed greatly toward bringing back the modern poetry to nature and originality, and to impress upon it the stamp of nationality. The ill success of the revolutionary struggle seemed for a time to have dealt a heavy blow to the progress of Hungarian literature, the most gifted writers having either fallen in battle (as Petöfi), or been imprisoned or banished. Time, however, opened the prisons and brought back the exiles; to the writers already mentioned others were added, and an active literary life again began. The greatest recent Hungarian poet is John Arany, who surpasses even Petöfi in artistic feeling, and whose national epic, 'Toldi,' is looked upon as a masterpiece. Baron Jósika holds the first place among the novelists; Jokai, Kuthy, Bérczy, Pálffy, Miksrath and Dobzsa are also favorite fiction writers. Narratives of travel have been written by Count Andrássy, Ladislaus Magyar, Vámbéry, etc.; on politics by Esengery, Szalay, Pákh and Eötvös. National history has attracted much attention; and besides the works of Szalay and Horváth, we should mention Teleki's 'Age of Hunyad,' Jászay's 'Hungary after the Battle of Mohács,' Salomon's 'The Rule of the Turks in Hungary,' etc. Many excellent translations of modern foreign works have been made, some of which, such as Esengery's translation of Macaulay's 'History of England,' and Somssich's translation of Guizot's 'Histoire de la Révolution d'Angleterre,' rival the originals in style. The best works on Hungarian literature are those of Toldy, Emil Reich and F. Riedl.

Music.— From the earliest stages of his known existence the Magyar appears to have had a special love for music and dancing, which found their place in every ceremonial, whether it was religion, war, rejoicings, sacrifices or funerals. Accompanying themselves on the lute, their minstrels sang the heroic deeds of fallen warriors. The Hun minstrels before them both sang and fought in battle. Chroniclers of the 10th century mention Hungarian hymns, dirges and martial songs. From this period, too, dates the well-known slow-moving national dance, called the «Hun step.» From very ancient times, lutes, violins, pipes, horns and tambourines were used by the Magyars. None of the melodies of those days survive. The first priests being Italians, they taught Latin songs; later, when natives (Magyars) became ordained, they composed hymns in their own tongue — subject to approval by the Holy Synod. Early in the 12th century Andreas Vásárhelyi wrote a song to the Virgin as Patroness of Hungary. Two Hungarian master-singers of European fame were Andreas Klinsor, who took part in the competition held at the Wartburg, near Eisenach, in 1208, and George Szlatkoni, a minor bishop at Saint Stephen's in Vienna and choirmaster to the Emperor Maximilian I. Foreign musicians — instrumentalists, singers, tutors and composers were attached to the Hungarian court under most of the kings. Church organs existed in Hungary in the days of Hunyadi. But the true missionaries of Magyar music were the wandering gipsies, first heard of — as musicians — in the 14th century. It was they who spread those weird, melancholy yet wild melodies over Europe just as their descendants may be found performing them (or something like them) all over Hungary at the present day. They enlivened humble peasants on the village green and the haughty nobles in their castles. Michael Barna, the «Hungarian Orpheus,» and Czinka Panna were distinguished musicians of the 18th century, while John Bihary composed those three fine dances, «Coronation,» «Palatine» and «Primate.» He had the honor of counting Beethoven in his audience, and his orchestra frequently played at the court balls in Vienna. They were all Hungarian gypsies, of the type that is now well known in London, Paris and New York as in their own country. A prominent part of the national music is the great collection of war songs, the composers of which can be numbered by the hundred. With the spread of the Reformation in Hungary the national music received a powerful impetus both sacred and secular. Huguenot hymns by Gaudimel (17th century) became naturalized on Hungarian soil. The lives of Thököly and Rákóczy represent the most brilliant period of Magyar folk-songs, the so-called *Kurutz* songs, of exquisite rhythm, from which nearly all the later songs, dances and melodies originated. Handel and Bach were babes when the Kurutz were sung and played. The great Liszt — himself a Hungarian — has placed it on record that «there is no other music from which European musicians can learn so much rhythmic originality as the Hungarian.» In addition to the innumerable «hallgató magyar» melodies, mainly played in public performances, Hungarian music includes a number of pretty dances, for the ballroom and the cottage, the former called the *Palace Dance* and *Slow Hungarian,* and the latter the *Dumping tune* and *Dance tune.* The *Verbunkos* is a recruiting dance, said to be unique. Other varieties are the *Wedding Dance, Coquettish, Drum Dance, Arm Dance, Tent Dance, Round Dance, Wreath Dance* and the celebrated *Csárdás* (chär'dash) or *Tavern Dance.* Three prominent dance composers of the 19th century are John Lavota, Anton Csermák and Mark Rozsavölgyi. An early opera composer was Sigismund Cousser (d. 1730); his works include ‘Erindo’ (1693), ‘Porus’ (1694), ‘Pyramus and Thisbe’ (1694), ‘Scipio in Africa.’ He was choirmaster in Dublin Cathedral for some years. Special mention must be made of John Francisci (b. 1691) as a brilliant organist.

A new era opened for music in Hungary at the dawn of the 19th century when the old clavichord developed into the forerunner of the modern pianoforte. Hungarian noblemen installed these instruments in their homes, with the result that many famous pianists settled in Hungary to engage in teaching. As former pupils of Haydn, Beethoven and Mozart, these tutors introduced the works of their great masters to the Hungarian aristocrats, among whom, it may be presumed, were some excellent players, for Beethoven dedicated several of his sonatas to Hungarian ladies. With the spread of music several Hungarian textbooks on piano instruction were issued, and a Hungarian (Stephen Gadi) wrote the first ‘School for the Piano’ (Buda 1809), followed by others. Nepomuk Hummel (1778–1837) left over 100 compositions. The greatest genius of Hungarian music was Franz Liszt (q.v.), the greatest pianist of the century, the creator of the Rhapsody and the Symphonic Poem. His contemporary, Franz Erkel (1810–60) was the creator of the Hungarian Opera, who reintroduced into his works long-forgotten native instruments with striking originality. Charles Goldmark (b. 1832) stands high as a composer of symphonies and operas: Queen of Sheba (1873), Sakuntala (1860) and other dramatic works.

In more recent years the Hungarian school of music and musicians has spread throughout the artistic world. Not only in composition of grand and light opera, ballet and chamber music and in prominent vocalists, but also in the domain of instrumentalists — on the violin, such masters as Joachim, and the large number of piano virtuosi who attract large audiences in American and European cities, has the Hungarian nation attained a position second to none. In 1819 and 1833 the first Hungarian conservatoires were founded at Kolozsvár and Arad; another in Budapest, followed by more in Debreczen, Kassa, Szeged and Szabadka. The National Hungarian Academy of Music (1875) had Liszt and Erkel as it first directors. Musical and choral societies are spread throughout the country, and historical concerts of the highest merit are periodically given in the academy of Science.

History.— The nations which occupied parts of Hungary before its conquest by the Magyars were the Dacians, Bastarnæ, Illyrians, Pannonians, Samatians, Vandals, Bulgarians, Jazyges, Alans, Huns, Marcomanni, Longobards, etc. The Romans held the southwest part of the country under the name of Pannonia, while the southeast belonged to their province of Dacia. Various Slavic tribes, together with Wallachians, Bulgarians and Germans, were the chief occupants at the time of the Magyar invasion. The Magyars, called

Hungari by the Latin writers, a warlike people of Turanian race, had made various migrations and long dwelt in the vicinity of the Caucasian Mountains, and afterward in the region between the Don and the Dniester, before they approached and crossed the Carpathians (about 887) under the lead of Almos, one of their seven chiefs (*vesér*), and elected head (*fejedelem*) or duke. Arpád, the son of Almos, conquered the whole of Hungary and Transylvania, organized the government, and also made various expeditions beyond the limits of these countries. These incursions were extended under his son Zoltán (907–46) and grandson Taksony (946–72), as far as the German Ocean, the south of France and Italy, and the Black Sea. These formidable enemies were first defeated by Henry I the German emperor, at Merseburg in 933; they then invaded Franconia in 937, and Saxony in 938, were defeated at Stederburg, and also on the river Ohre. Their last incursion into Bavaria (954 and 955) terminated with their complete overthrow on the Lech, where Otho I, king of the Germans, conquered them. They gradually learned from the Slavonians and Germans whom they conquered, and from the prisoners whom they had taken in their incursions, the arts of peace, agriculture and manufactures. The hospitality of Geysa (972–97), and the religious zeal of Sarolta his wife, did much to attract strangers from different countries and of all classes into Hungary. The Hungarians violently opposed the introduction of Christianity and Geysa was obliged to leave the extension of it to his son Stephen (997–1038), who finally prevailed by the assistance of Latin monks and German knights. King Stephen granted a constitution, the principal features of which were never lost, but the unsettled state of the succession to the crown, and the consequent interference of neighboring princes and of the Roman court in the domestic concerns of Hungary, long retarded the prosperity of the country. The religious zeal and bravery of Saint Ladislaus (1077–95), and the energy and prudence of Coloman (1095–1114), shine amid the darkness of this period.

The introduction of German colonists from Flanders and Alsace into Zips and Transylvania by Geysa II (1141–61) had an important influence on those districts. In 1186 Hungary became connected with France by the second marriage of Béla with Margaret, sister to Henry, king of France, and widow of Henry, king of England, who introduced French elegance at the Hungarian court. The reforms of Béla IV (1235–70) were interrupted by the invasions of the Mongols (1241), and the kingdom was in a most deplorable condition. After one year of pillage they left the land a desert. With Andrew III (1290–1301) the male line of the Arpád dynasty became extinct, and the royal dignity became purely elective. Charles Robert of Anjou, by his mother a descendant of the extinct dynasty, was the first elected (1309). The reign of his descendant Sigismund (1387–1437) is interesting from the invasion by the Turks (1391) and the war with the Hussites. The Turks routed the army of Sigismund, reinforced by the flower of Western chivalry, in 1396. From their first appearance the Turks constantly disturbed the tranquillity of Hungary which served as a bulwark to the rest of Europe. The death of Ladislaus I in the unfortunate battle of Varna (1444) is to be regretted, as the plan of the hero John Huniades, for driving the Turks from Europe, failed through the coldness of the Christian courts and the intrigues of his enemies.

Matthias Corvinus (1458–90), son of Huniades, held the reins of government with a firm hand, and gained the love and confidence of the nation, notwithstanding the severe measures which he was often compelled to adopt.

During the reigns of Ladislaus II (1490–1516) and Louis II (1516–26) the ambition and rapacity of the optimates, headed by Stephen Zapolya, and afterward by his son John excited domestic troubles and caused an insurrection of the peasants, which was only suppressed by the severest measures (1514), while they destroyed the foreign influence of the kingdom. The battle of Mohács (1526), in which Louis II lost his life, and which for 160 years made a great part of Hungary a Turkish province, was the natural consequence of this state of things. The rest of the country was in dispute between the rivals Ferdinand of Austria and John Zapolya. The contest was decided by the Protestants, who, fearing the persecution of Zapolya, declared for Ferdinand, who thus became the first Hapsburg king of Hungary, a connection that endured through the reigns of 16 monarchs till 1918. Zapolya was compelled to rest satisfied with the possession of Transylvania and some counties of Upper Hungary; but this division of the kingdom caused continual disputes with the descendants of Zapolya, instigated by the Turks and the French, and gave rise to civil commotions, which were quieted by the treaties of Vienna with Stephen Botskay (1606), of Nikelsburg with Gabriel Bethlen (1622), and of Lintz with George Rakoczy (1645). Deliverance from the Turk came when, in 1683, Kara Mustapha besieged Vienna and John Sobieski, king of Poland, and Duke Charles of Lorraine relieved the city and routed the Turkish army. After the expulsion of the Turks Leopold I finally succeeded so far that he took Buda (1686), and by the Peace of Carlowitz (1699) recovered the rest of Hungary (except the Banat) and Transylvania. Joseph I became king in 1705. With England, Holland and Savoy he fought against Louis XIV under the Duke of Marlborough and Prince Eugene. Joseph inherited from his father the long struggle of the Magyars against Austrian encroachment on their liberties. Persecution of the Protestants led to revolt in Hungary, which Joseph suppressed. He granted a general amnesty, observed the constitution and made peace with his people in the year of his death (1711), ending 200 years of continuous war.

The Congress of Passarowitz (1718) restored the Banat to Hungary, and the Peace of Belgrade (1739) terminated hostilities with the Porte for a long time. Charles VI (1711–40) by the Pragmatic Sanction secured the inheritance of the Hungarian crown to the female descendants of the house of Hapsburg, and improved the administration of the kingdom by giving the royal chancery and the vice-regal office an organization better suited to the age. He also formed a standing army for Hungary, and established the military contribution for its support. Joseph II (1780–90), one of the greatest sovereigns of his age, was influenced by the best intentions in the changes which he undertook in the Hungarian constitution; but his zeal made him forget the necessity of proceeding gradually in such reforms, and the nation, far from entering into his views, opposed them.

The subsequent history of Hungary — the adoption of the Magyar language in its Diet; the resistance against the encroachments of Austria; the heroic struggles for independence, and the noble work of Batthyani, Deák, Kossuth and Klauzal along these lines; the disastrous war of 1848 and the reduction of Hungary to the position of an Austrian crownland; its rehabilitation to independence in 1867 and the constitution of the former dual Austro-Hungarian Empire, are described under AUSTRIA.

HUNGARY AND THE WAR. It is too early yet to weigh — with even approximate accuracy — the influence and responsibility of Hungary in provoking the war and abetting the designs of Austria and Germany. Two circumstances, however, seem to be clearly revealed: Whereas Austria was drawn or pushed into the war without the consent of Parliament or people, in Hungary, on the other hand, the war was popularly declared — by Magyars — to be a Hungarian war, and the fact that it had spread to such gigantic proportions was regarded with rather a feeling of national pride. Vienna, during the first months of the conflict, was apathetic and anxious; Budapest was enthusiastic and confidently jubilant. The long tradition of Austria's «facility for defeat» weighed heavily upon her people; neither doubt nor misgiving clouded the Hungarian vision. The one-sided Dual Compromise of 1867 had invested Hungary — or rather the Magyar gentry — with two-thirds of the power in the monarchy and left Austria with the burden of defraying two-thirds of the costs. Though the foreign relations of the empire were exclusively in the hands of the Austro-Hungarian Minister in the Reichsrath in Vienna, his policy not infrequently was dictated from Budapest or Berlin. (See AEHRENTHAL; BERCHTOLD). Nearly every important official in the Foreign Office is a Hungarian. Vienna was nominally the capital of the empire, but Hungary was practically an independent country in which the ruling classes, as we have already pointed out, stood in the minority. Yet it would have been no very difficult task for the Magyars, by genuine constitutional government and a policy of conciliation, to build up a powerful and united state. The Slav races under their control would have accepted Magyar leadership the more willingly as they themselves had formerly been oppressed by Austria as severely as the Magyars had been. The few prominent Hungarian statesmen, such as Deák and Eötvös, who had endeavored in the past to secure political justice for the non-Magyars were overruled. Since 1875 the «Magyar State» idea developed into a ruthless policy of «Magyarization,» in pursuance of which coercive measures were employed to crush out the national sentiments and languages of the greater part of the population. Newspapers and banks fell into the hands of Magyarized Jews who became the most ardent promoters of the cause. All non-Hungarian place-names and, by persuasion, the surnames of prominent persons underwent the process. Thus, Pressburg became Pozsony; Vienna, Bécs (bătch); Klausenburg, Kolozs; Hermannstadt, Szeben. The real name of Munkácsy the painter was Lieb; that of Vambéry, Bamberger; Toldi the author was originally Schebel; Petöfi the poet was a Slav, Petrovitch; Komlóssy was Kleinkind, and the ethnologist Hunfalvy was Hundsdorfer, etc. Letters from Austria bearing German place-names were returned «not known,» though every child in the town knew the two names. Austrian postal authorities retaliated by returning letters addressed «Bécs» (Vienna) with the inscription, «place not known.» The inevitable consequences of the Magyarization policy was that the Croats, Serbs and Dalmatians looked toward Serbia for deliverance; Rumanes turned their hopes to Rumania, Ruthenes to Russia and the Slovaks to their kinsmen of Bohemia and Moravia. The races of Austria were free to use their national languages, and since 1907 enjoyed universal suffrage. Under Hungarian dominion the Magyar language alone was recognized, while the constitutional suffrage became a dead letter. (See *Government*). Koloman Tisza (1830–1902) inaugurated and pursued the Magyarization policy during his 15 years of the premiership; it was continued by his son Stephen (Count) Tisza, who became the most dominant personality in the empire. He was murdered a few days before the end of the war, in the progress of which he, and not the Austrian Foreign Minister, attended the German war councils. His policy bore retributive fruit early in the war in the defection of Austro-Hungarian Slav regiments. It brought about the Czecho-Slovak and Jugoslav risings, their fighting on the Allied side, their eventual recognition as belligerents and independent states by the Allies, and, finally, the collapse of the empire followed shortly after by the surrender of Germany. See AUSTRIA; CROATIA-SLAVONIA; CZECHO-SLOVAKS; JUGOSLAVS; SLAVS; TISZA; TRANSYLVANIA; WAR, EUROPEAN.

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HUNGERFORD, Margaret Hamilton Wolfe Argles ("THE DUCHESS"), Irish novelist: b. Ross, Ireland, about 1855; d. Bandon, County Cork, 24 Jan. 1897. She was the daughter of a vicar choral of Cork Cathedral and the death of her first husband, Edward Argles, left her with a young family to support, whereupon she took to writing novels, using the pseudonym "THE DUCHESS." Later she was married to T. H. Hungerford. Her more than 30 novels were widely popular both in America and England and without possessing a large amount of literary value are cleverly written, entertaining fictions. Among them may be cited 'Phyllis' (1877); 'Molly Bawn' (1878); 'Airy Fairy Lillian' (1879); 'Beauty's Daughters' (1880); 'Mrs. Geoffrey' (1881); 'Portia' (1882); 'O Tender Dolores' (1885); 'Green Pastures and Gray Grief' (1886); 'A Modern Circe' (1887); 'The Duchess' (1887); 'Undercurrents' (1888); 'Hon. Mrs. Vereker' (1888). Consult Taisin, A., 'Best Sellers of Yesterday' (in *Bookman,* Vol. XXXVIII, p. 645, New York 1914).

HUNKERS (supposably from Dutch *honk,* "post" or "station"; "stick-in-the-muds"), in American politics, at present a contemptuous nickname, like "moss-backs," for the unprogressive elements of a party, which detest change. Originally, a name given about 1844 to the section of the New York State Democrats which opposed new issues: the points for which it then stood, however, had become party tenets from about 1835. Thence till 1840 the Hunker faction was in opposition to the Locofoco wing (q.v.) which opposed bank charters; but was obliged to yield in 1838. From 1840 to 1846 they opposed the Radicals, who wished a revised State constitution, elective judges and cessation of State canal building. Thence till 1852 they opposed the Barnburners (q.v.), who, at first separately and then in alliance with the Free-Soil party (q.v.) fought the National Democratic party for recognition of its State power. After the election of Pierce in 1852, it divided into "hards" and "softs"; the first under Daniel S. Dickinson opposed the administration, the second under William L. Marcy supported it. The former made up the bulk of the "War Democrats" after 1861. Besides those named, Horatio Seymour is the best remembered Hunker leader; while the opposition has the familiar names of Martin Van Buren, Silas Wright and John A. Dix, besides others remembered by the older generation.

HUNNERIC, a king of the Vandals in Africa, who flourished in the 5th century; d. 484. He succeeded his father, Genseric, in 477. In 435 he was sent to Italy as a hostage. He married a daughter of Theodoric, king of the Visigoths. When she was suspected of an attempt against the life of his father, Hunneric caused her ears and nose to be cut off and sent her home. He later married Eudocia, daughter of Valentinian III, emperor of Rome.

HUNNEUS, u̇n-nā'u̇s, **George,** Chilean statesman: b. Santiago, Chile, 1831; d. 1889. He was graduated at the university of his native town in 1857, and became professor of political economy and jurisprudence at the same institution the following year. Montt, President of Chile, drove him out of the country on account of his forceful eloquence and his liberal opinions, which he found carried into actuality in the government of the United States, where he spent his time of banishment. He was recalled to his native land in 1861, was elected to the House of Representatives and became its speaker. He was also appointed Secretary of Public Instruction and became rector of Santiago University, while holding from time to time high positions in the Chilean administration. His collected works, chief of which is 'La Constitución ante el Congress' (1879), were edited by his sons and published by the government as 'Obras' (4 vols., Santiago 1890–91).

HUNS, a people who make their appearance in authentic history about 375 A.D. Ethnologists identify them with a Mongolian people of northern Asia, who invaded the Chinese Empire about 200 B.C., and after various migrations entered Europe. They appear afterward to have sided with the Goths of Mœsia against the Romans, and sometimes in alliance with the emperors, who purchased their services, and sometimes in hostility with them, they continued to extend their dominion along the Danube until the time of Attila (434), their greatest leader, whose reign constitutes the best-known period of their history. See ATTILA.

HUNT, Gaillard, American historian and author: b. New Orleans, 8 Sept. 1862. He studied at Emerson Institute, Washington, and in 1893 represented the State Department at the World's Fair at Chicago. From 1900–09 he was chief of the Bureau of Citizenship; and after 1909 was chief of the Division of Manuscripts in the Library of Congress. He attained great prominence on matters of citizenship, being appointed a member of the Naturalization Commission (1905); a member of the Citizenship Board (1906), and adviser to the Department of State on citizenship matters (1915 and 1917). In 1913 he lectured on nationality at the Graduate School of Political Sciences at George Washington University, and on materials for history at Johns Hopkins. Dr. Hunt is the author of 'The Seal of the United States' (1892), revised as 'History of the Seal of the United States' (1909); 'The Department of State of the United States' (1892), revised and enlarged as 'The Department of State of the United States, Its History and Functions' (1914); 'The American Passport' (1898); 'Life of James Madison' (1902); 'John C. Calhoun' (in 'American Crisis Biographies,' 1907); 'Disunion Sentiment in Congress in 1794' (1905); 'Life in America One Hundred Years Ago' (1914). He is editor of 'Fragments of Revolutionary History' (1891); 'The Writings of James Madison' (8 vols.); 'The First Forty Years of Washington Society' (1906); 'The Journals of the Continental Congress in Succession to Worthington C. Ford' (1909); 'James Madison's Journal of Debates in the Constitutional Convention' (1917).

HUNT, Helen. See JACKSON, HELEN FISKE HUNT.

HUNT, Henry, English politician and reformer: b. Widdington Farm, Upavon, Wiltshire, 6 Nov. 1773; d. 15 Feb. 1835. He received some training for the ministry, but abandoned this for farming. After his acquaintance with John Horne Tooke he adopted those radical views which made his career a particularly stormy one. He suffered imprisonment for duelling in 1800, and for attacking a gamekeeper in 1810. Again, he was a speaker at a meeting held in Saint Peter's field, Manchester, which ended in a riot; and he was imprisoned for two and a half years. His following continued to increase rapidly. In 1830 he sat in Parliament for Preston, but failed of re-election in 1833. His term was occupied with the forwarding of radical reforms, such as women's rights, universal suffrage and the repeal of the corn laws. Hunt was extremely vigorous and blatant in his speeches, and gained considerable reputation as an orator. He retired from politics in 1833. He wrote 'Memoirs of Henry Hunt, written by himself in His Majesty's Jail' (London 1820). Consult Huish, R., 'Life of Hunt' (1836).

HUNT, Henry Jackson, American soldier: b. Detroit, Mich., 14 Sept. 1819; d. Washington, D. C., 11 Feb. 1899. He was graduated from West Point in 1839, receiving a commission in the artillery. He saw service in the Canadian Rebellion 1837–38; afterward in the Mexican War. In General Scott's advance on the City of Mexico he distinguished himself as officer of the artillery at Contreras (18 Aug. 1847) and Churubusco (20 Aug. 1847) and subsequently received the brevet rank of major for gallantry. In 1856 he was placed on the board engaged in revising the system of light artillery tactics. At the outbreak of the Civil War he was stationed at Fort Pickens, Fla., 1861, and the same year commanded the artillery at the battle of Bull Run, and in the defense of Washington. He subsequently organized and commanded the reserve artillery of the Army of the Potomac. As commander of artillery he was present at the battle of Malvern Hill (1 July 1862) and he also took part in the battle of South Mountain. He was brevetted brigadier-general of volunteers in 1862, and was present at the battles of Antietam, Fredericksburg, Chancellorsville, Gettysburg, served in the Wilderness campaign and at the end of the war retired from his position with the rank of brigadier-general in the United States army. In 1866 he received the commission of colonel in the reorganized army, and in 1883 became governor of the National Soldiers' Home at Washington. Among his writings are 'Instruction for Field Artillery' (1860) and 'The Battle of Gettysburg' (in 'Battles and Leaders of the Civil War' (New York 1887).

HUNT, (James Henry) Leigh, English journalist, essayist and critic: b. Southgate, Middlesex, England, 19 Oct. 1784; d. Putney, near London, 28 Aug. 1859. He was the youngest of a large family of children, and was descended on the one side from Tory cavaliers of West Indian adoption, and on the other from American Quakers of Irish extraction. From his father, an improvident and engaging clergyman of convival habits and of lax doctrines, Hunt seems to have inherited his optimism of temperament, his liberal views and his courage of conviction; from his mother, a passionate love of nature and of books. From birth a delicate child, he early developed hypochondriacal tendencies that never left him. The years from 1791 to 1799 were spent at Christ's Hospital, and were his only formal preparation for a literary life. In 1801 his father published 'Juvenilia,' a collection of Hunt's poems written from the age of 12 to 17. They show wide reading and some fluency in versification, but are mostly poor imitations. From 1803 to 1805 he worked in his brother Stephen's law office and, at the same time, began his long career as a journalist with contributions to *The Traveller, The News* and other papers. His theatrical criticisms were reprinted separately in 1807.

His next position was in the office of the Secretary of War, resigned in 1808 in order to start his political journal, *The Examiner,* in its far-reaching effects the most significant step of his career. With his brother John as publisher, he continued editor until 1821. *The Examiner* was a departure from the standards of contemporary journalism in its combination of the news-giving quality of the daily sheets with the essay style of the weeklies (Fox-Bourne, 'English Newspapers'). Discussion of politics was its chief object. The liberal policy and boldness of attack of the editor caused one charge of libel by the Tory government to follow closely upon the heels of another. The third resulted in prosecution and conviction for applying to the Prince Regent, afterward George IV, the phrase «a fat Adonis of fifty.» The two brothers were sentenced to imprisonment of two years, dating from 15 Feb. 1813, in separate prisons, and a fine of £1,000 to be divided between them. They rejected offers from the government to remit the punishment on condition that *The Examiner* should change its attitude, and served the full sentence. Hunts finances, which up to this time had been good, became greatly involved during his incarceration. Not until 1844 was he free from want. His health suffered greatly from the long confinement. *The Reflector* (1810–12) had much the same political and literary character as *The Examiner.* The chief measures for which Hunt labored through these journals were Catholic emancipation, reform of Parliamentary representation, liberty of the press, reduction and equalization of taxes, greater discretion in increasing the public debt, education of the poor and amelioration of their sufferings, cessation of child labor, abolition of the slave trade, reform of military discipline and of prison conditions and of criminal and civil laws. After Hunt's release from prison he was never again so active in political matters.

In 1809 Hunt married Marianne Kent. She was an invalid the greater part of her life; consequently, the «hugger-mugger» condition of domestic affairs which so greatly distressed the Carlyles. Curiously enough, Hunt was allowed to continue *The Examiner* while in prison. During that time he republished from *The Reflector* his 'Feast of the Poets,' a wholesale satire on contemporary poets in the manner of Suckling's 'Session of the Poets.' It antagonized the literary world, as *The Examiner* had done the political, and played a large part in creating the antagonism of *Blackwood's* and the *Quarterly* toward Hunt, which resulted in the creation and the long and bitter persecution of the so-called Cockney School. The 'Descent of Liberty' appeared in 1815. The 'Story of Rimini' (1816), also written in prison, was the most important of Hunt's poems up to that time, and brought him into immediate notoriety. For its influence on his contemporaries, particularly Keats, in the use of idiomatic language, and in the revival of the free, heroic couplet, it is the most important of Hunt's poems. It was at once denounced as most pernicious and immoral by the *Quarterly* and *Blackwood's.* 'Foliage' (1818) contains some of Hunt's best epistles and sonnets. 'Hero and Leander' and 'Bacchus and Ariadne' appeared jointly in 1819, and a translation of Tasso's 'Amyntas' in 1820. His prose style of this period reached its best expression in *The Indicator,* in essays of the occasional and personal type. They are distinguished by a unique charm and tenderness, by delicate humor and keen observation.

During Hunt's imprisonment he had made the acquaintance of Byron, Shelley, Moore and Lamb. The friendship with Keats probably did not begin until the winter of 1816. In the case of Shelley it was the beginning of a wonderful friendship that involved personal sympathy and public defense with his pen on the part of Hunt, and much financial aid on the part of Shelley. It was through the latter that Byron, in 1821, invited Hunt to Italy to undertake the management of *The Liberal,* an ultra-political-literary journal, suddenly abandoned after a few months of unsuccessful running. The failure of the project led to Byron's desertion of Hunt and his family in a foreign land, and Hunt's revenge in 1828 in the shape of 'Lord Byron and Some of his Contemporaries,' an error which Hunt later greatly deplored. During the stay in Italy he edited the *Literary Examiner,* wrote 'Ultra Crepidarius,' a satire on William Gifford, translated the 'Bacchus in Tuscany' of Redi, and contributed the 'Wishing-Papers' to *The Examiner.* He returned to England in 1825 in great poverty. From this time on his work consisted of editing numerous magazines: *The Companion* (1828), *Chat of the Week* (1830), *The Tatler* (1830–32), *Leigh Hunt's London Magazine* (1834–35), *Monthly Repository* (1837–38), *Leigh Hunt's Journal* (1850–51), unsuccessful because of the great impracticability of the schemes and the monotony of one chief contributor; of contributing to an incredible number of other magazines; of publishing reprints from previously edited journals and collected editions of his «poetical works»; of selections from other writers made with running comment or introductory essays, as 'Imagination and Fancy' (1844), 'Wit and Humor' (1846), 'Stories from the Italian Poets' (1846), of guidebooks, as 'The Town' (1848), and 'The Old Court Suburb' (1855). His only novel, 'Sir Ralph Esher,' appeared in 1832. 'The Legend of Florence' was produced at Covent Garden in 1840. His 'Autobiography' was published in 1850, and in a revised form in 1859; the 'Correspondence' posthumously in 1862.

Hunt's best prose work is to be found in his 'Autobiography' and in his essays of the kind already mentioned as having appeared first in *The Indicator.* Carlyle said of the former, «except it be Boswell's of Johnson, I do not know where we have such a picture drawn of a human life as in these volumes.» Though less of a poet than an essayist, some of his short poems are exquisite, notably the famous 'Abou Ben Adhem,' 'Mohammed,' 'Jaffar,' 'The Nile,' 'On a Lock of Milton's Hair,' 'Paganini' and others. As a translator, some of his work is admirable. Hunt's powers of criticism and of selection will not be fully recognized until scattered notes and buried prefaces are collected. He had an inborn love of poetry and all beautiful things. His insight was most remarkable of all in the appreciation of his contemporaries. His personal quality was as rare as his opportunity. He had a personal ascendency, a strange fascination born of the sympathy and chivalry, the sweetness and joyousness of his nature. Barry Cornwall said that he was «compact of all the spicy winds that blow.»

Bibliography.— Hunt's works have never been collected and as a whole are difficult of access. His poems and essays, except in small selections and cheap editions, are out of print.

The best edition of the former is that edited by S. Adams Lee (Boston 1857); of the latter *The Indicator* and *Companion* (2 vols., London 1834). Scribner publishes in a uniform edition some of the most popular of his works. Consult also Johnson, R. B., ‹Leigh Hunt› (1896); Monkhouse, Cosmo, ‹Life of Leigh Hunt› (1893); Clarke, ‹Recollections of Writers› (1878); Trelawney, ‹Recollections of the Last Days of Shelley and Byron› (1858). Frequent references to Hunt are to be found in the writings of Byron, Shelley, Keats, Carlyle, Dickens, Lamb, William Hazlitt and Alexander Ireland. Excellent bibliographies of Hunt's works are to be found in Ireland's ‹Lists of the Writings of William Hazlitt and Leigh Hunt› (1868); Monkhouse's ‹Life of Leigh Hunt› mentioned above, and R. B. Johnson's ‹Essays and Poems of Leigh Hunt› (Temple Library 1891).

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HUNT, John, English clergyman and missionary: b. Balderton, Nottinghamshire, 1812; d. Fiji Islands 1848. He studied theology at the Wesleyan Theological Institution at Hoxton, and was sent in 1838 to the Fiji Islands. Here he won many converts to Christianity and established numerous missions. His works, which were published posthumously, include ‹Entire Sanctification: Its Nature, the Way of Attainement and Motives of Its Pursuit› (1853); ‹Memoir of Rev. W. Cross, Missionary to the Friendly and Feejee Islands› (1848); ‹Wesley and Wesleyanism› (London 1858). Consult Rowe, G. S., ‹The Life of John Hunt, Missionary to the Cannibals› (London 1859).

HUNT, Richard Morris, American architect: b. Brattleboro, Vt., 31 Oct. 1828; d. Newport, R. I., 31 July 1895. He began the study of architecture in Europe at an early age, attended the École des Beaux-Arts in Paris, traveled in Germany, Italy, Asia Minor and Egypt, and under his former teacher, Lefuel, was clerk of the works on the buildings that were erected to connect the Tuileries with the Louvre. In 1855 he returned to the United States and proceeded to signalize himself by a remarkable series of noble architectural creations, such as the Capitol extension at Washington; the Lenox Library, New York; the Yorktown Monument, Virginia; Presbyterian Hospital, New York; Tribune building, New York; Fogg Museum, Cambridge, etc. He also designed the pedestal for Bartholdi's colossal statue of ‹Liberty Enlightening the World› on Bedloe's Island, New York Harbor. He was also chiefly instrumental in the artistic success of the World's Fair at Chicago for which he designed the administration building. Some of the finest private houses in the country were built by him on a truly palatial scale of magnificence, such as those of W. K. Vanderbilt, E. T. Gerry, H. G. Marquand, J. J. Astor, Ogden Mills, etc., in New York; the country house of George Vanderbilt at Biltmore, N. C.; the so-called «Marble House» and the «Breakers» at Newport, and many other residences at the Rhode Island resort. He was one of the founders and president of the Institute of Architects; an associate of the Academie des Beaux-Arts; member of the Royal Institute of British Architects and holder of its gold medal; a chevalier of the Legion of Honor, and a member of numerous other domestic and foreign societies. In 1892 he was made an associate member of the Institute of France. He held the honorary degree of LL.D. from Harvard. There are two monuments to his memory in New York city: a fountain by D. C. French on Fifth avenue opposite the residence of H. C. Frick and a life-sized statue on top of the W. K. Vanderbilt residence. Through his artistic and structural faculty he exercised a profound influence over American architecture. Consult Anon., ‹A Reminiscence and an Appreciation› (in *Architectural Record,* Vol. XXXIX, p. 295, New York 1916); id., ‹The Richard M. Hunt Memorial› (in *Engineering Record,* Vol. XXXVIII, p. 493, New York 1898); Cortissoz, R., ‹R. M. Hunt› (in ‹Art and Common Sense,› New York 1913); Schuyler, M., ‹Works of R. M. Hunt› (in *Architectural Record,* Vol. V, p. 97, New York 1896); Van Brunt, H., ‹R. M. Hunt› (in *American Architect,* Vol. L, p. 53, Boston 1895).

HUNT, Theodore Whitefield, American Presbyterian clergyman and educator: b. Metuchen, N. J., 19 Feb. 1844. He was graduated from Princeton 1865 and from Princeton Theological Seminary 1869; was instructor in English at Princeton 1868–71 and professor of English there from 1873. He published ‹The Principles of Written Discourse› (1884); ‹English Prose and Prose Writers› (1887); ‹Studies in Literature and Style› (1890); ‹Ethical Teachings in Old English Literature› (1894); ‹American Meditative Lyrics› (1896); ‹English Meditative Lyrics› (1899); ‹Literature — Its Principles and Problems› (1906); ‹English Literary Miscellany› (1914).

HUNT, Thomas Sterry, American chemist, mineralogist and geologist: b. Norwich, Conn., 5 Sept. 1826; d. New York, 12 Feb. 1892. In 1845 he became an assistant to the elder Silliman at Yale College; was chemist and mineralogist to the Canadian Geological Survey 1847–52, professor of chemistry at Laval University, Quebec, 1856–62, and at McGill University 1862–68, and professor of geology in the Massachusetts Institute of Technology 1872–78. In 1859 he invented the green ink with which greenbacks (q.v.) are printed. He was made an officer of the Legion of Honor in 1867; Fellow of the Royal Society in 1859, and was president of the Royal Society of Canada in 1884. He was also a member of the National Academy of Sciences; a member and president of the American Association for the Advancement of Science; a member of the American Institute of Mining Engineers, and of the American Chemical Society. One of the organizers of the first Geological Congress he became its secretary, and acted as vice-president of the Geological Congresses at Paris (1878), Bologna (1881) and London (1888). Among his published books are ‹Chemical and Geological Essays› (Boston 1875); ‹Coal and Iron in Southern Ohio, etc.› (Boston 1881); ‹Mineral Physiology and Physiography› (Boston 1886); ‹New Basis for Chemistry› (New York 1887; Paris 1889); ‹Systematic Mineralogy› (New York 1891). Some 400 papers of varying length, published in scientific journals of the United States, Canada, England, France and Germany, attest to his remarkable industry. Consult Douglas, J. B., ‹T. S. Hunt› (in

American Philosophical Society, Proceeding, Memorial Vol. I, p. 63, Philadelphia 1900); Frazer, P., ‘T. S. Hunt’ (in *American Geologist,* Vol. XI, Minneapolis 1893); Laflamme, J. C. K., ‘Le Docteur T. S. Hunt’ (Quebec 1892).

HUNT, William Henry, English water-color painter: b. London, 28 March 1790; d. 10 Feb. 1864. Born of poor parents and crippled in childhood, Hunt became the pupil of John Varley, the landscape painter. He exhibited three paintings in oil in 1807; but later painted exclusively in water-color, becoming an associate of the Water-Color Society in 1824 and full member three years later. He painted genre and still life with great delicacy and variety of color, so that Ruskin in his criticism has these words of praise for him: «He was, take him for all in all, the finest painter of still life that ever existed.» His humor, accuracy and technical expertness made his genre scenes particularly popular. Of these the best known are ‘Boy and Goat’; ‘The Card Players’; ‘Too Hot’; ‘Plums, Primroses and Birds’ Nests.’ Hunt ranks high in the group of founders of the English school of water-color painters. He lived for the best part of his life at Hastings.

HUNT, William Henry, American lawyer: b. New Orleans, La., 5 Nov. 1857. He was educated at Yale; became attorney-general of Montana in 1884; and held various public offices there after Montana became a State. He was for a time United States agent before the Chilean Claims Commission, but resigned that post in 1900 to become secretary of Porto Rico, and from 1901 to 1904 was governor of the island. He then became United States district judge for Montana; from 1910–11 was associate judge of the United States Court of Customs Appeal, and from 1911–14 served as associate judge of the United States Commerce Court.

HUNT, William Holman, English painter of religious subjects: b. London, 2 April 1827; d. there, 7 Sept. 1910. He studied at the Royal Academy in 1845, and next year exhibited his first picture, ‘Hark!’ representing a child holding a watch to her ear. His early years as an artist were spent in great poverty. About 1848 Hunt, D. G. Rossetti and J. E. Millais formed the Pre-Raphaelite Brotherhood, afterward enlarged by the admission of other painters and writers, and which attained a position of great influence through the eloquent support of Ruskin. Each of the three founders exhibited in 1849 a picture painted in strict accordance with the principles of the Brotherhood. Hunt's picture represented ‘Rienzi Vowing to Obtain Justice for the Death of His Younger Brother,’ and was exhibited at the Royal Academy. The exhibition of 1854 included two of his greatest pictures, one of them the well-known ‘Light of the World,’ now in Keble College, Oxford, and a life-size copy in Saint Paul's, London. Both it and ‘The Awakening Conscience’ are characterized by the careful draughtsmanship and attention to detail which form notable features of the best Pre-Raphaelite work, but their full meaning is far from clear to the average spectator. In 1854 Hunt went to Palestine in order to obtain a living acquaintance with the scenes of the Biblical stories, and the first fruits of his study of Eastern life was ‘The Scapegoat’ (1856), one of his most original and most poetical works; but much finer is his ‘Finding of the Saviour in the Temple,’ exhibited in 1860. Among subsequent works of Hunt's are ‘A Street Scene in Cairo — the Lantern-Maker's Courtship’ (1861); ‘Portrait of D. G. Rossetti’ (1850); ‘Fairlight Downs’ (1858); ‘The After-Glow in Egypt’ (1865), «that modern masterpiece of technical art»; ‘Isabella, or the Pot of Basil’ (1868), based on the well-known story from Boccaccio utilized by Keats, and in respect of coloring the finest of the artist's works; ‘The Shadow of Death’ (1873), showing a prevision of the Crucifixion in the carpenter shop where Jesus is working beside His mother; ‘The Triumph of the Innocents’ (1885), one of his masterpieces; ‘Christ among the Doctors’ (1860). In 1857 he received only one vote when put up as an associate of the Royal Academy and afterward set his face against academic honors; but he was awarded the coveted Order of Merit in 1905. His talents were consecrated to the depiction of sacred subjects, which are chosen with great attention to detail. Consult his ‘Pre-Raphaelitism and the Pre-Raphaelite Brotherhood’ (2 vols. 1905); the biographies or studies by Coleridge (1908); Farrar and Meynell (1893); Stephens, F. G., ‘William Holman Hunt and His Works’ (1905); and Bayliss, ‘Five Great Painters of the Victorian Era’ (1902).

HUNT, William Morris, American painter: b. Brattleboro, Vt., 31 March 1824; d. Isles of Shoals, 8 Sept. 1879. In 1840 he entered Harvard University, but ill health obliged his removal before completion of the course. He traveled in Europe, studied at Paris under Couture and subsequently came under the influence of Jean François Millet. Hunt introduced the Barbizon School to America after his return home in 1855. Settling in Boston, he was very successful as an art teacher; painted several pictures reminiscent of his French travels and in general turned American aspirants in art toward France. His best works are ‘Sheep-Shearing at Barbizon’; ‘The Fortune-Teller’; ‘The Prodigal Son’; ‘The Farmer's Return’; ‘Girl with Kitten’; ‘Girl Reading’; ‘Marguerite’; ‘Hurdy-Gurdy Boy.’ He is well represented in the Boston Museum. The Metropolitan Museum, New York, contains his ‘Girl at a Fountain’; ‘A Landscape’; ‘The Bathers’ and other examples. Among his portraits are those of Chief Justice Shaw, Mrs. F. G. Ward, Mrs. Charles Francis Adams, Mrs. G. W. Long, William H. Gardiner, William M. Evarts, Horace Gray. The Albany capitol contained colossal decorations by Hunt which were later either covered or removed. He published ‘Talks about Art’ (London 1878). Consult Knowlton, H. M., ‘The Art Life of William Morris Hunt’ (Boston 1899); and Isham, Samuel, ‘History of American Painting’ (New York 1903).

HUNTER, David, American soldier: b. Washington, D. C., 21 July 1802; d. there, 2 Feb. 1886. He was graduated at West Point in 1822, became captain in 1833, and resigning from the army in 1836 settled in Chicago. He, however, re-entered the army in 1842 as paymaster with the rank of major, and in May 1861 was appointed brigadier-general of volunteers, and a few month later major-general. He recruited and organized in South Carolina the first negro regiment in the Union army. In 1863 his manumission of the slaves in Florida, Georgia and South Dakota was annulled by the President. He defeated the Confederates at Piedmont, 5 June 1864, and was chairman of the military commission which tried the conspirators engaged in the assassination of President Lincoln. He was brevetted major-general in the regulars 1865, and retired in 1866.

HUNTER, Edward, American soldier: b. Gardiner, Me., November 1839. He was graduated from West Point in 1865, and was commissioned second lieutenant in the 12th Infantry, and a few months later, first lieutenant. He served as aide-de-camp to General Getty at Santa Fe, N. M., in the operations against the Arapahoe and Cheyenne Indians. In 1870 he was transferred to the 1st Cavalry; and for subsequent meritorious services in California, Nevada, Washington and Montana was commissioned captain. In 1888 he became major and was appointed judge-advocate in the division of the Pacific and the Department of California (1889–95). He was made lieutenant-colonel and deputy judge-advocate in the Department of Dakota (1895–98). In the last-named year he accompanied General Brooke as judge-advocate in Porto Rico. He occupied a similar office in the Department of the East a few years later, and was officially retired in 1903.

HUNTER, George Leland, American author and expert on interior decorating: b. Bellingham, Mass., 8 May 1867. He was graduated at Harvard in 1889, and devoted many years to the study of furniture and textiles. His publications include ‘Tapestries, their Origin, History and Renaissance’ (1912); ‘Home Furnishing’ (1913); ‘The House That Jack Built’ (1914); ‘Italian Furniture and Interiors’ (1917); ‘Decorative Textiles’ (1918). Mr. Hunter was also decorative art editor of the ‘New International Encyclopedia,’ and has organized exhibits of tapestries at various museums.

HUNTER, John, British surgeon and physiologist: b. Long Calderwood, Lanarkshire, 13 Feb. 1728; d. London, 16 Oct. 1793. He was a younger brother of William Hunter (q.v.). In 1749 and 1750 he studied surgical pathology at Chelsea Hospital, London, and already began to make original observations, which his subsequent experience confirmed. In 1754 he was entered as a surgeon pupil at Saint Georges Hospital; and in 1754 or 1755 he was admitted to a partnership in his brother's school of anatomy, and continued to lecture there till 1759. He served as staff-surgeon in France and Portugal 1760–63, and then returned to London and commenced practice as a surgeon. In 1767 he was elected a member of the Royal Society, and in 1768 was appointed surgeon to Saint George's Hospital. His investigations at this time extended over every branch of natural history, particularly pathology, comparative anatomy and physiology, to which he devoted his entire leisure time. In 1790 he was appointed inspector-general of hospitals and surgeon-general to the army. Hunter left at his death a museum which he had built for himself, and filled with upward of 10,000 preparations illustrative of the departments of science to which his attention had been devoted. It was afterward purchased by government and presented to the Royal College of Surgeons. His leading works are the ‘Natural History of the Human Teeth’ (1771); ‘Treatise on the Venereal Disease’ (1786); ‘Observations on Certain Parts of the Animal Economy’ (1786); ‘Treatise on the Blood, Inflammation and Gun-shot Wounds’ (1794). The complete works, edited by Palmer, were published in 1838.

HUNTER, Peter, Canadian administrator and soldier: b. Scotland, 1746; d. Quebec, 1805. He served in the Revolutionary War and rose to the rank of lieutenant-general and commander-in-chief of the forces in British North America (1799). In this capacity he was also appointed successor to Gen. John Graves Simcoe as lieutenant-governor of Upper Canada. His administration was severely critized because of his neglect of civil and preference for military duties. Reforms instituted by him were improvements in the system of representation and the trade agreements between the United States and Upper Canada. Later critics have given more favorable estimates of Hunter, laying emphasis on his fair-mindedness and capability in face of the great difficulties involved in the administration of a poorly organized and not wholly responsible government.

HUNTER, Robert, British colonial governor of New York and Jamaica: d. 1734. He was of an Ayreshire family, and entered the military service. He fought at Blenheim and became colonel of dragoons. In 1707 he was made lieutenant-governor of Virginia, but was captured by the French en route and was held prisoner until his captors found it expedient to exchange him for the bishop of Quebec. Three years later he returned to America with a group of German Protestants who had sought escape from persecution in England. Colonel Hunter remained as governor of New York for nine years, during which time he was continuously occupied with dissensions with the colonial assemblies. He returned to England in 1719, and remained a short while, when he was sent out as governor of Jamaica and major-general of the troops stationed there. He fulfilled these commissions very ably.

HUNTER, Robert Mercer Taliaferro, American statesman: b. Essex County, Va., 21 April 1809; d. 18 July 1887. He was graduated at the University of Virginia, and, choosing the law for his profession, commenced practice in 1830. He soon began to take an active part in politics, and at 24 was elected to the house of delegates, where he remained until 1837, when he was elected to Congress. In the discussions growing out of the commercial convulsion of that year, he at once took his stand on the side of the administration in favor of the independent treasury bill, and in his first speech developed those principles of free trade to which he consistently adhered throughout his public career. In the succeeding Congress he was elected to the speakership; and at the close of his term of service, the usual vote of thanks was passed without a dissenting voice, in a House of Representatives strongly marked by partisan bitterness. At the election in the spring of 1843 for members of the 28th Congress, Hunter was defeated by a small majority, mainly on account of his adherence to that clause of the independent treasury scheme requiring all dues to the government to be paid in species. At the next Congressional election in 1845, he was successful. In 1846 Hunter, in common with other southern representatives, resisted the application of the Wilmot Proviso. He voted for all the measures necessary to prosecute the war to a just and honorable conclusion, but altogether opposed the project, favored by some, of incorporating the whole of the Mexican states into our political system. He represented Virginia in the Senate, 1847–61. He was active in framing the Tariff Act of 1857, and after leaving the Senate became the Confederate Secretary of State. At a later period he was a Confederate senator, and in 1865 commissioner of peace. He became treasurer of Virginia in 1877, and retired from public life in 1880. Consult the memoir by M. T. Hunter (1903).

HUNTER, William, British anatomist: b. Long Calderwood, 23 May 1718; d. London, 30 March 1783. After studying at Glasgow University 1732–37, and subsequently medicine at Edinburgh, he went to London in 1741, and in 1746 received the appointment of lecturer on anatomy to a society of naval surgeons. In 1747 he became a member of the College of Surgeons and practised surgery and midwifery, but at length confined himself entirely to the latter, and was appointed accoucheur to the British Lying-in Hospital. In the first volume of 'Observations and Inquiries,' published by the Medical Society in 1757, appeared Hunter's 'History of an Aneurism of the Aorta.' In 1762 he published 'Medical Commentaries,' and in 1764 was appointed physician-extraordinary to the queen. In 1768, on the establishment of the Royal Academy of Arts, he was appointed professor of anatomy. The most elaborate of his publications, the 'Anatomy of the Human Gravid Uterus,' appeared in 1774. In 1770 he purchased and completed a house and theatre, in which he constituted a splendid museum. At first he only contemplated a collection of preparations in human and comparative anatomy, but added a collection of shells, corals and other objects of natural history, paintings and ancient coins and medals. He bequeathed the whole of his splendid museum, valued at £150,000, to the University of Glasgow, with the sum of £8,000 in cash to be expended in an appropriate building for its reception, and a further sum of £500 per annum to bear the charges of its preservation.

HUNTER, Sir William Wilson, English statistician and author: b. Glasgow, 15 July 1840; d. 1900. He was educated at the University of Glasgow and foreign universities and appointed to the Bengal Civil Service in 1862. As director-general of statistics he made a statistical survey of India, the results of which are embodied in the well-known *Imperial Gazetteer of India* (1881; 1885–87). He also published 'Annals of Rural Bengal' (1868; 5th ed., 1872), continued in 'Orissa' (1872); 'The Life of the Marquess of Dalhousie' (1890); 'A Dictionary of the Non-Aryan Languages of India and High Asia' (1868); 'Brief History of the Indian Peoples' (1880; enlarged ed. as 'The Indian Empire' (1895), which has been translated into five languages, and was editor of the series of biographies known as 'The Rulers of India.' He was knighted in 1887.

HUNTER-BLAIR, Oswald (Sir David Hunter-Blair, 5th Baronet), Scottish clergyman: b. Dunksey, Scotland, 30 Sept. 1853. He was educated at Eton and at Magdalen College, Oxford. Entering the army he was commissioned in the Prince Regent's Royal Ayrshire Militia, becoming captain in 1876. He was converted to Roman Catholicism in 1875 and three years later became a member of the Benedictines. He was ordained to the priesthood in 1886, and from 1890 to 1895 was rector of the Abbey School at Fort Augustus. In 1896 he succeeded to the baronetcy on the death of his father. From 1899 to 1909 he was master of Hunter-Blair's Hall, Oxford, and since 1913 has been abbot of Saint Benedict's Abbey, Fort Augustus, Scotland. He was a private chamberlain to the late Leo XIII and spent some time in Brazil employed in educational research for his order. He published 'Jerusalem of To-day'; 'Catholics at the National Universities'; 'Oxford as It Is'; 'History of the Catholic Church in Scotland,' a translation of the 'Geschichte der katholischen Kirche in Schottland' of Bellesheim; 'Holy Rule of St. Benedict,' and contributions to the *Tablet*, the *Weekly Register*, the *New Era*, the *Glasgow Observer* and 'The Catholic Encyclopedia.'

HUNTER COLLEGE. See Normal College.

HUNTING, the pursuing of wild animals as a sport. Hunting for the market is termed pot-hunting. Among sportsmen certain conventionalities obtain, and the hunter who does not observe these unwritten rules is stigmatized as unsportsmanlike.

Within comparatively recent years the indiscriminate slaughter of wild game has moved the devotees of the sport of hunting to insist upon such regulations, statutory or self-imposed, as shall protect game birds and animals from extinction, and afford them a «sporting chance» to escape an unskilful hunter. In the extension of this idea many sportsmen of the higher type deliberately reduce their chances of killing the game by substituting the rifle with its one missile for the shotgun with its widely scattering scores of deadly pellets. What may be called the «new thought» among American sportsmen is well expressed in the «Sportsman's Platform,» adopted by «The Camp-Fire Club of America» in 1909 as an official code of hunting ethics. It may be epitomized by «planks» 12 and 13, which declare: «The killing of an animal means the end of its most interesting period. When the country is fine, pursuit is more interesting than possession. The best hunter is the man who finds the most game, kills the least, and leaves behind him no wounded animals.»

The complete disappearance from the United States of several kinds of game birds and animals which formerly were abundant and the depletion of other species to almost the point of extinction has united the sportsmen of the country in an effort to check the further ravages of the pot-hunter and those who find their pleasure in wholesale slaughter. As one instance of the danger of unrestrained «gunning» in areas where game is plentiful the following figures taken from a report of the State Game Commission of Louisiana for the season 1909–10 are enlightening. While it is stated that the record can be regarded as only approximate, it shows the killing of 3,176,000 wild ducks, 1,140,750 quail and 1,402,474 other game birds; 5,470 deer, 690,270 squirrels and rabbits and 1,971,922 other fur-bearing animals — a total for one season for that State alone of 8,386,876 game birds and animals. Most of the «hunters» who bagged this game were hired men sent into the State by wholesale dealers in game in distant markets.

With such incentives to action to prevent the total destruction of the wild life of the country sportsmen have worked actively to have suitable game laws passed in the several States, urging especially the protection of closed seasons for appropriate terms of years, in order to give vanishing species a chance to multiply again to such numbers that a surplus could be spared without danger of extinction. A lack of uniformity in the State laws, however, has been a serious obstacle to the success of a country-wide plan. Within recent years the Department of Agriculture in the exercise of its authority over migratory birds has aided to a considerable degree the preservation of several species which were subjected to indiscriminate slaughter both while going north to their nesting places and on the return trip to their winter habitat. There have been established also by Presidential executive orders a number of bird refuges which have served to stem the tide of unreasoning destruction. But much remains to be accomplished, and the struggle is still on between those who would save the game, and with it the sport of hunting, and those who would heedlessly and selfishly destroy both the game and the sport.

Dr. William T. Hornaday, the well-known hunter-naturalist, designates as the principal remaining game areas in North America: the Arctic prairies north of the tree limits; the Alaska-Yukon region; the northern extensions of the Canadian provinces, Ontario and Quebec; Labrador and Newfoundland; British Columbia, and the Sierra Madre of Mexico. In 1912 the hunting grounds in and near the United States and southern Canada where big game may still be found in numbers which permitted hunting without danger of extermination were:

The Maine Woods — for white-tailed deer.

New Brunswick — for moose, caribou, deer and black bear.

The Adirondacks — for white-tailed deer.

The Pennsylvania Mountains — for deer and black bear.

Northern Minnesota — for deer and moose.

Northern Michigan and Wisconsin — for white-tailed deer.

Northwestern Wyoming — for elk, deer, grizzly bear and black bear.

Western and Southwestern Montana — for elk, mule deer and white-tailed deer.

Northwestern Montana — for mule deer and white-tailed deer.

Wyoming east of the Yellowstone Park — for elk, deer and two species of bear.

Woods of Northern Ontario and Northern Quebec — for moose and deer.

Southern British Columbia — for mountain goat, mountain sheep, deer and grizzly bear.

Northern British Columbia — for moose, elk, bighorn sheep, grizzly bear and black bear, mule deer and white-tailed deer.

Northwestern Alberta — for grizzly bear, bighorn sheep and mountain goat.

The hunting of large game, as bear, deer, tigers, lions, leopards, etc., will be found treated under the titles by which they are described. In Europe the various modes of shooting game are known as open shooting, covert shooting, river and pond shooting and salt-water wild fowl shooting. See Deer Stalking; Fox Hunting; Game Laws; Game Preserves, etc.

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HUNTING-DOG. See Hyena-dog.

HUNTING LEOPARD. See Cheeta.

HUNTINGDON, Selina Hastings, Countess of, English Methodist leader: b. 24 Aug. 1707; d. 17 June 1791. She was married in 1728 to the Earl of Huntington and on his death in 1746 became very devout, appointing the famous George Whitefield (q.v.) her private chaplain. Adopting the principles of the Methodists, she was long considered, owing to her rank and fortune, as the head of the Calvinistic Methodists, her followers being known as the «Countess of Huntingdon's Connection.» She founded a college at Trevecca in Wales for the education of ministers, built some 64 chapels and contributed liberally to their endowment and to the support of the clergy. Consult New, A. H., ‹The Coronet and the

Cross, or Memorials of Selina, Countess of Huntingdon' (London 1857); Tytler, S., 'Countess of Huntingdon and Her Circle' (London 1907).

HUNTINGDON, England, a municipal borough, capital of Huntingdonshire, situated on the Ouse, 59 miles north of London, and served by the Great Northern, Great Eastern and Midland railways. The town was originally settled by the Saxons, and was the seat of a royal castle built in the 10th century. It was chartered in 1189. It is connected by bridge with Godmanchester. Huntingdon is famous principally as the birthplace of Oliver Cromwell, whose birth is registered in the books of the old parish church of Saint John. His house is still standing. Pop. 4,000. Consult Griffith, Edward, 'A Collection of Ancient Records relating to the Borough of Huntingdon' (1827).

HUNTINGDON, Pa., borough, county-seat of Huntingdon County, on the Juniata River, and on the Pennsylvania Railroad, about 200 miles west of Philadelphia. Where Huntingdon is located was once a famous council ground for the Indians of the central part of Pennsylvania, now marked by the «Standing Stone Monument» erected at the centenary celebration. It was first settled by white people in 1760 and was chartered in 1796. The country around is a fertile agricultural region, with valuable mineral deposits and quite extensive forests. The chief manufactures are boilers, machinery, radiators, sewer-pipe, flour, furniture, stationery, knit goods and stoves and there is an important trade in grain and fruits. Huntingdon is the seat of the State Industrial School and of Juniata College, an institution opened in 1876 under the auspices of the German Baptist Brethren. The original charter is still in force and provides for a chief burgess, who holds office three years, and a council. Pop. 6,861.

HUNTINGDONSHIRE, England, an east-midland county, bounded on the east by Cambridgeshire, on the west and north by Northamptonshire and on the south by Bedfordshire. Area, 366 square miles, of fertile rolling valley. The chief streams are the Ouse and the Nene; the Kym joins the Ouse at Saint Neots. Agriculture is the principal occupation of the county, about nine-tenths of the entire area being under cultivation, or used for pasturage. Wheat, barley, beans, peas, fodder, cabbage and mangold are raised, and there is also considerable truck-farming, bee-cultivation and cattle raising; and some dairy-farming. The manufactures consist of paper and parchment, brick tile and ale. Railways traversing the country are the Great Northern, the Great Eastern and the London and North-Western. The chief cities are Godmanchester (Pop. 2,000); the capital, Huntingdon (Pop. 4,250) and Saint Ives (Pop. 3,000). The county is rich in historical remains, some of which date back to Roman times. Huntingdonshire was settled by an East Anglian tribe in the early 6th century and has shared in the vicissitudes of the struggles between the Anglians and Mercians; the Danes and the Saxons. Pop. 56,000.

HUNTINGTON, Archer Milton, American author: b. New York, 10 March 1870. He received his education in New York and in Spain, and became deeply interested in Spanish archæology. Dr. Huntington is known chiefly in the United States as the founder and first president of the Hispanic Society of America. Under his auspices, the society became a flourishing organization; for, besides endowing it heavily, he gave it a building, splendid collections and library. Yale awarded him the degree of honorary A.M. in 1897, and Harvard in 1904; Columbia, the degree of Litt.D. in 1907. Besides numerous criticisms and magazine articles, he is the author of 'A Note Book in Northern Spain' (1898), and 'Sonnets' (1908); and editor of 'Lady Aulnoy's Travels into Spain' (1899); 'The Poem of the Cid' (3 vols., text, translation and notes, 1897) and numerous Spanish textbooks.

HUNTINGTON, Collis Potter, American capitalist: b. Harwinton, Conn., 22 Oct. 1821; d. Pine Knot Camp, near Lake Raquette, N. Y., 13 Aug. 1900. He worked on his father's farm, until his 14th year. In his 16th year he procured credit in New York for $3,000 worth of clocks and traded them through the South and West. He then, together with one of his brothers, set up as a general merchant at Oneonta, N. Y., where he prospered immediately. He shipped goods to California in 1848; followed them in person in 1849 by way of the Isthmus where he was detained for three months on account of the overcrowded conditions. During this time he used his small capital to such good purpose that he increased it from $1,200 to some $5,000. He then took ship to California and began to make his fortune in the hardware business, soon becoming associated with Mark Hopkins (q.v.). In 1860 he matured a plan for a transcontinental railroad in conjunction with Leland Stanford, Charles Crocker and Mark Hopkins. The Central Pacific was finished in 1869. This was the crowning achievement of his life and at his death the railroad system known as the Southern Pacific, of whose managing board he was president, comprised 26 corporations, with more than 9,000 miles of tracks and 5,000 miles of steamship line. Another achievement was the upbuilding of the Chesapeake and Ohio Railroad and the accompanying marvelous development of Newport News, Va. He was one of the largest landholders in the country and his fortune was estimated at $35,000,000. He built a granite church, to the memory of his mother, in his native town; gave C. W. Peale's portrait of Washington to the New York Metropolitan Museum; a library and reading-room to Westchester, N. Y.; materially aided in building and equipping Hampton (Va.) Normal Agricultural Institute; and gave $50,000 for the endowment of Tuskegee (Ala.) Normal and Industrial Institute. He was one of the foremost art collectors of his time, leaving a magnificent collection of paintings, valued at $3,000,000 to the New York Metropolitan Museum, the bequest to become operative after the death of his wife and adopted son. Consult Anon., 'C. P. Huntington' (in *Review of Reviews*, Vol. XXII, p. 325, New York 1900).

HUNTINGTON, Daniel, American painter: b. New York, 14 Oct. 1816; d. there, 18 April 1906. He was educated at Hamilton College, where he made the acquaintance of Charles

L. Elliott, from whom he received a decided bias for his art. In 1835 he entered the studio of Professor Morse, president of the National Academy of Design and soon after produced the ‘Bar-room Politician’; ‘A Toper Asleep,’ besides some landscapes and portraits. In 1839 he went to Europe and in Florence painted the ‘Sibyl’ and the ‘Florentine Girl.’ Removing to Rome soon after, he painted the ‘Shepherd Boy of the Campagna,’ and ‘Early Christian Prisoners,’ both of which were purchased by New York collectors. In 1845 he returned to New York. He became a member of the National Academy in 1840 and was its president in 1862 and 1869, and continuously from 1877 to 1891. He devoted himself mainly to portraits and among portraits by him of well-known people are those of Presidents Lincoln and Van Buren and of Sir Charles Eastlake. His noted ‘Mercy's Dream’ is now in the Corcoran Gallery at Washington.

HUNTINGTON, Ellsworth, American explorer and author: b. Galesburg, Ill., 16 Sept. 1876. After receiving his B.A. from Beloit College, he became president's assistant and instructor at Euphrates College, Harput, Turkey (1897–1901). His first tour of exploration was along the canons of the Euphrates River in 1901. Returning to the United States, he was research assistant at the Carnegie Institution, Washington; and from 1903–04 was a conspicuous member of the Pumpelly expedition to Russian Turkestan. From 1905–06, he traversed Chinese Turkestan with the Barrett expedition. He taught at Yale University subsequently, becoming assistant professor (1910–15), and research associate since 1917. Other noteworthy explorations conducted by Huntington were to the Syrian Desert, Palestine and Asia Minor (1909); and for investigations of climatic conditions in the United States, Mexico and Central America (1910–13). He received his degree of M.A. from Harvard (1903) and his Ph.D. from Yale (1909). Dr. Huntington is associate editor of the *Bulletin* of the American Geographical Society and the *Journal of Race Development*. Various geographical and ethnological societies have distinguished him by medals and election to their membership. He is author of ‘Explorations in Turkestan’ (1905); ‘The Pulse of Asia’ (1907); ‘Palestine and its Transformation’ (1911); ‘Asia — a Geography Reader’ (1912); ‘The Climatic Factor as Illustrated in Arid America’ (1914); ‘Civilization and Climate’ (1915); ‘Human Geography’ (1917).

HUNTINGTON, Frederic Dan, American Protestant Episcopal bishop: b. Hadley, Mass., 28 May 1819; d. Hadley, Mass., 11 July 1904. He was graduated at Amherst in 1839, and studied three years in the divinity school of Cambridge. In 1842 he was ordained pastor of the South Congregational (Unitarian) Church in Boston, which he left in 1855 after a highly successful pastorate to become the first occupant of the college pulpit and Plummer professor of Christian morals at Harvard. During these years he was also a highly successful lecturer on the lyceum platform, a form of popular education then at its height. He spoke on philosophical, historical and theological subjects and his eloquence was as impressive there as in the pulpit or the classroom. From 1847–51 he edited the *Christian Register* and from 1845–59 the *Monthly Religious Magazine*. In 1860 he resigned and took orders in the Episcopal Church, founding Emmanuel Church, Boston, and serving as its rector 1861–69. In April 1869 he was consecrated bishop of Central New York with residence at Syracuse. He has published ‘Sermons for the People’ (1856); ‘Christian Believing and Living’ (1859)’ ‘Divine Aspects of Human Society’ (1859); ‘Helps to a Holy Lent’ (1872); ‘New Helps to a Holy Lent’ (1876); ‘Fitness of Christianity to Man: Bohlen Lectures’ (1877); ‘Christ in the Christian Year’ (2 vols., 1878), ‘Forty Days with the Master’ (1892), etc. Consult Huntington, A. S., ‘Memoir and Letters of F. D. Huntington’ (Boston 1906).

HUNTINGTON, Lucius Seth, Canadian statesman: b. Compton, province of Quebec, 1827; d. New York, 1886. He was elected to the Canadian Parliament in 1861 and was solicitor-general for Canada East 1863–64. In 1873 he moved in the House of Commons for inquiry into the alleged corrupt practices in connection with the proposed transcontinental railway, afterward called the “Pacific Scandal.” He held office in the Mackenzie administration from 1874–78 and retired from public life in 1882. He was the author of a novel on English and American political life, ‘Professor Conant.’

HUNTINGTON, Margaret Evans, American educator: b. Utica, N. Y., 9 Jan. 1842. In 1869 she was graduated at Lawrence University and subsequently studied at Berlin, Paris, Heidelberg and Oxford. In 1874 she began her connection with Carleton College as professor of English literature and dean of the women's department. After 1879 she served as president of the Minnesota Congregational Board of Missions and from 1885 to 1899 of the Minnesota Federation of Womens' Clubs. She was also chairman of the Minnesota Public Library Commission and was the first woman member of the American Board of Commissioners for Foreign Missions of the Congregational Church. In 1908 she was elected honorary vice-president for life of the General Federation of Womens' Clubs. In 1914 she married the Rev. George Huntington. She has published several addresses and the volume entitled ‘Woman as Citizen.’

HUNTINGTON, Samuel, American jurist: one of the signers of the Declaration of Independence: b. Windham, Conn., 3 July 1731; d. Norwich, Conn., 5 Jan. 1796. Although at first intended for a farmer and merchant he managed to study law and soon became a successful lawyer at Norwich, Conn. From 1765–74 he was king's attorney; from 1775–83 associate justice of the Superior Court of Connecticut, of which he became chief justice in 1784. In 1764 he began service in the general assembly, advancing in 1775 to the senate or governor's council. In spite of this long service as an officer of the Crown, his sympathies were strongly on the side of the colonists and, in January 1776, he entered the Continental Congress as a delegate from his native State. In September 1779 he succeeded John Jay as president of Congress and discharged the functions of that office until July 1781 when he resumed his seat on the Connecticut bench. He served again in Congress from May to June, 1783, and in the succeeding year was appointed chief justice of the Superior Court of Connecticut. In 1785 he was elected lieutenant-governor of Connecticut and in 1786 he succeeded Roger Griswold as governor, to which office he was annually re-elected until his death. Consult Huntington, S., 'S. Huntington' (in *Connecticut Magazine*, Vol. VI, p. 247, Hartford 1900).

HUNTINGTON, William Edwards, American university president: b. Hillsboro, Ill., 30 July 1844. He served in the Civil War as private in the 40th, and first lieutenant in the 49th Wisconsin Infantry. After the war, he studied at Wisconsin University, and prepared himself for the ministry, being ordained in the Methodist Episcopal Church in 1868. He held pastorates at Nahant, Mass. (1870–71); Roslindale (1872–74); Newton (1875–76); Cambridge (1877–79); Boston (1880–82). He received the degree of Ph.D. at Boston University in 1881, and in the following year became dean of the College of Liberal Arts. From 1904–11 he was president of that university, and dean of the graduate department (1911–17).

HUNTINGTON, William Reed, American Episcopal clergyman: b. Lowell, Mass., 20 Sept. 1838; d. 1909. After graduation from Harvard in 1859 he took orders in the Episcopal Church, was assistant at Emmanuel Church, Boston, 1861–62, rector of All Saints, Worcester, Mass., 1862–63, and from 1883 until his death was rector of Grace Church, New York. He was prominent in the councils of the Episcopal Church, an acknowledged leader of the Broad Church school of thought and author among other works of 'A National Church' (1898); 'Sonnets and a Dream' (1904).

HUNTINGTON, Ind., city, county-seat of Huntington County, on the Little River, and on the Chicago and Elkhart, the Wabash, C., B., & C. railroads, and the Fort Wayne-Northern Indiana Traction Line, about 26 miles southwest of Fort Wayne and 70 miles southeast of South Bend. It was settled in 1834, incorporated as a town in 1848 and received its charter in 1873. Its chief manufactures are boots and shoes, pianos, lime, cedar chests, furnaces, rubber specialties and railroad cranes. It has railroad shops and wood-working factories. The trade, in addition to the manufactures, is from crushed stone, lime-kilns near by and agricultural products. It is the seat of the United Brethren College. The public library has over 30,000 volumes. The city owns and operates the electric-light plant and the waterworks. A commercial association of over 500 members is maintained. Pop. 15,106.

HUNTINGTON, N. Y., town in Suffolk County on Long Island. It is on Long Island Sound and on the Long Island Railroad. Huntington originally included the village of Babylon and other adjoining places. As first laid out, the area was 150 square miles. The first settlement was made in 1653, and the first deed of land given to actual settlers was made on 2 April 1653, on behalf of the Matinecock tribe of Indians, and conveying to the whites six square miles between Cold Spring and Northport. The consideration paid was six coats, six kettles, six hatchets, six "howes," six shirts, 10 knives, six fathoms of wampum, 30 "muxes," and 30 needles. Additional lands were purchased in 1656–58. The early settlers were nearly all Puritans from England. The inhabitants of Huntington were among the first of the colonists to protest against "taxation without representation." From the first agriculture was the chief occupation; but trade with the West Indies began at an early date. In 1675 Thomas Fleet was listed as owning 40 vessels. Whales were often caught along the south coast. Nathan Hale (q.v.) was captured in Huntington. The place of capture is marked by a boulder, a shaft and a drinking fountain. The town celebrated its 250th anniversary on 4 July 1903. Large market gardens are in parts of the town, but much of it is a favorite residential suburb of New York. Pop. 15,357.

HUNTINGTON, W. Va., city and capital of Cabell County, on the Guyandotte Valley, the Chesapeake and Ohio and the Baltimore and Ohio railroads, and on the Ohio River, 300 miles southwest of Pittsburgh, and 160 miles northeast of Cincinnati. The city, named after the late Collis P. Huntington, was founded and incorporated in 1871. It is an important commercial and industrial centre and among its industrial establishments are the car manufacturing shops of the Chesapeake and Ohio Railroad, foundry and machine shops, lumber and planing mills, manufactures of woodwork, glass, stoves, bricks, pottery, ice, bottling and meat-packing establishments. The city is regularly laid out, has 64 miles of paved streets, water 99 plus pure, complete modern sewer system, average temperature 54.5. "Five Cent Gas" for manufacturing purposes — domestic 15 cents. Nine banks. The city is noted for its educational establishments, which includes Marshall College (the State Normal School), Saint Edward's College, numerous graded schools and a high school with a building that cost $300,000. Commission form of government. Pop. 43,571.

HUNTINGTON'S DISEASE, hereditary chorea, a comparatively rare disease, commencing in middle life, was first described by Dr. George Huntington of New York in 1872. At times it is hard to distinguish from locomotor ataxia (q.v.). The offspring of adults thus affected are likely to have congenital or hereditary chorea.

HUNTSVILLE, Ala., city and county-seat of Madison County, on the Nashville, Chattanooga and Saint Louis and the Southern railroads, 96 miles due north of Birmingham, 97 miles due west of Chattanooga, 125 miles south of Nashville and 210 miles east of Memphis. The city is located in the heart of the famous Tennessee Valley, and is surrounded by a large and fertile agricultural cotton, fruit and stock-raising country, making it an important commercial centre. As a cotton manufacturing point, its spindles lead the South, and is second only to Lowell, Mass. Its nine cotton mills have 203,000 spindles, with 4,374 looms, the annual product of which amounts to $8,500,000 in sheet cloth, knitted goods, khaki cloth, drilling and printing cloth. These mills own 1,246 acres of land and have 34½ acres of floor space, support and maintain three Y. M. C. A. buildings, four libraries and trained nurses for the benefit of the employes. Besides these, Huntsville has machine and foundry shops, cottonseed-oil mills, hoop and heading factory, fibre and planing mills, brick plants, sanitary dairy, mattress factory, broom factory, canning factory, wholesale grocery stores, wholesale seed store, wholesale millinery store, flour mills, bonded warehouses, private warehouses, carriage works, wholesale and retail lumber yards, cottonseed and fertilizer plants; one of the largest nurseries in the world, and one of the largest nursery sections in the United States. The annual pay-roll is $2,018,100. The government of the city is by commission, this being one of the first cities of the State to adopt this form. The city has paved streets, gas and electric plants, electric car lines, paid fire department and municipal waterworks, with a daily capacity of 24,000,000 gallons. The city is well supplied with a number of private schools, and an excellent public city school with new modern building erected at a cost of $25,000. Four miles north of the city is located the Alabama Agricultural and Mechanical College for Negroes. There are 11 churches, a city infirmary and other notable buildings, including Elks' home and theatre cost $110,000, Y. M. C. A. cost $75,000 and four banks.

The first settler here was John Hunt, a Virginian and a soldier of the Revolution, who came to the «Big Spring» in 1805, built his cabin, the first, nearby and in 1806 went back to Tennessee and brought his family, having lived in that State before coming to Alabama. In 1811 the town was incorporated by the Territorial legislature as Huntsville. The first State constitutional convention was held here 5 July 1819. The first legislature sat here and assembled on the first Monday in August 1820, and this was the first capital of Alabama. Pop. (1910) 7,611, but the city corporate limits have not been extended in 50 years; estimated population including suburbs and mill district is about 20,000.

HUNTSVILLE, Canada, a town in Muskoka County, about 150 miles north of Toronto on the Grand Trunk Railway. The waterworks and electric light plant are owned by the municipality. The chief manufactures are lumber, leather and machinery. Huntsville is also a well-known summer resort, attracting numerous visitors. Pop. about 2,500.

HUNTSVILLE, Mo., city and county-seat of Randolph County, on the Wabash Railroad, 150 miles northwest of Saint Louis and 122 miles northeast of Kansas City. It is situated in an agricultural and coal-mining region. Its principal industrial establishments are flour mills, machinery shops, rake and stacker factory. Its trade is chiefly in agricultural and mining implements, live stock and farm products. Pop. 2,247.

HUNTSVILLE, Tex., city, county-seat of Walker County, on the International and Great Northern Railroad, about 200 miles southeast of Austin and 72 miles north of Houston. The first settlement was made about 1835. It is in a fertile agricultural region in which cotton, one of the large crops, is the staple of trade. The chief manufactures are cotton goods, cottonseed oil, cigars, steam-engines, foundry products, agricultural implements, furniture, ice, corn-meal, and wagons. Here are the home and grave of Gen. Sam Houston, and the grave of H. Yokum, the first historian of Texas, which are of historic interest; the main State Penitentiary, and the Sam Houston State Normal School are located in this city. Pop. 2,072.

HUNYADY, János, Hungarian statesman and soldier: b. about 1387; d. 11 Aug. 1456. Little is known of his early life, but while still a youth he entered the service of Sigismund. His prowess was recognized by that monarch and by his successor, Albert II. He was made royal councillor and received gifts of large estates. In 1438 he was made ban of Szöreny, on the border of Transylvania, a difficult post which necessitated constant vigilance to repel the Turkish incursions then at their high tide. During the civil war in which Hungary was engaged after Albert's death in 1439, Hunyady supported Ladislas III of Poland, defeated the Turks in several battles and in 1443 secured from them favorable terms of peace. After the battle of Varna, Hunyady was made regent during the minority of Ladislas Posthumus. He lost the decision over the Turks at Kossovo in 1448, was imprisoned by the Serbians for a short time when he was ransomed by the Magyars. In 1456 he successfully defended Belgrade against the hosts of Islam. The plague broke out soon after the Turks raised the siege and Hunyady fell a victim to its ravages. To Hunyady is due the repulse of the Turk and the saving of Western civilization. He was also a great military genius; was the first to raise a regular army in the modern sense; and the first to make general use of tactics and strategy. Consult Teleki, J., 'The Age of the Hunyadis in Hungary' (Perth 1857); Vambéry, A., 'Story of Hungary' (New York 1894), de Chassin, J., 'Jean de Hunyad' (Paris 1859).

HUON PINE (*Dacrydium Franklinii*), a timber tree of Tasmania, of the order *Coniferæ*. It grows in swampy land, chiefly along the upper Huon River, and attains a height of 75 to 100 feet. It is exceedingly valuable as timber, being used extensively in ship building, because of its close-grained quality.

HUPA, hoo'pạ, an Indian tribe of Athabascan stock, inhabiting the Hupa Valley Reservation, California. Their original settlement was also in this locality, along the lower part of the Trinity River. They number about 650. Consult Goddard, P. E., 'Life and Culture of the Hupa' (University of California *Publications*, Vol. I, 1903).

HUPEH, hū'pā, China, a province in the central part, bounded on the north by Honan, east by Ngan-hui, south by Hunan and west by Shensi and Szech'uen. Irrigation and means of transportation are supplied by the Yang-tse River which traverses the southern part, and the Han, which, after many windings, joins the Yangtsze Kiang at Hankow. Agriculture is extensively carried on, the principal products being cotton, wheat, tea, tobacco, beans and rape seed. The country is a level, marshy plain, with some mountains of the Ta-pa-shan and Fu-miu groups in the north. The principal ports are Hankau, Ichang and Shashi, and the capital is Wuchang on the Yang-tse, opposite Hankow. Hanyang on the Han has extensive iron and steel works, utilizing the products of the great coal fields and iron mines of the province. Area, 71,410 square miles. Pop. (estimated) 21,260,000.

HURA, hū'rą, a genus of euphorbiaceous plants of which the best known is *Hura crepitans,* common in the West Indies and in the American tropics. The stalk contains a milky juice; the leaves are acuminate, thick and heart-shaped. The seeds are contained in a tough, large, woody capsule, shaped like an apple flattened at the ends, and are embedded in carpels, of which there are from 12 to 15, surrounding a common axis. From the use of the hollowed fruit as a sandbox, the plant became known as the «sandbox tree.»

HURLBUT, Jesse Lyman, American Methodist Episcopal clergyman: b. New York City, 1843. After studying at Wesleyan University, he held successive pastorates at Newark, Montclair, Paterson, Bloomfield and other towns in New Jersey. He rendered important service in the Sunday school work of his community, was secretary of the Epworth League, and with Dr. J. H. Vincent was active in the superintendency of the Chautauqua Literary and Scientific Circle. From 1909–14 he was district superintendent of the Newark district. His publications include 'Manual of Biblical Geography' (1882); 'Outlines in Old Testament History' (1890); 'Our Church' (1902); 'Story of the Bible' (1905); 'Outline Studies in the New Testament' (1906); 'Teacher Training Lessons' (1908); 'Organizing and Building up the Sunday School' (1909); 'Traveling in the Holy Land Through the Stereoscope' (1913); 'The Superintendent's Helper' (1915); 'Story of the Bible for Boys and Girls' (1917); 'Story of the Christian Church' (1918).

HURLEY, Wis., town, capital of Iron County, on the Montreal River, at the State boundary, opposite Ironwood, Mich., 49 miles by rail east by south of Ashland, on the Chicago and North Western, the Milwaukee, Lake Shore and Western and the Wisconsin Central railroads. It is in a rich iron mining district and has saw-mills and considerable lumbering intrests. Pop. 3,000.

HURLING, an ancient field sport, to which the modern game of hockey owes its origin. A field 150 × 84 yards is required, marked across at 21, 50 and 75 yards from either end. The goals at the ends are indicated by posts, 21 feet apart, connected by a crossbar at a height of eight feet. Twenty-one feet from each goal post is a point post, 16 feet high. The implements for the game are the ball, made with a cork centre, bound with wool and cased in leather, five inches in diameter and weighing seven ounces; and the hurley stick, similar to a short ice-hockey stick, held in the left hand. Teams are composed of 17 players. The object of the game is, as in hockey, to drive the ball between the opponent's goal posts. The ball, or «slitter» may be caught by the hand, but must be played with the stick. In a locked play, the ball may be moved with the foot. The game is played in Ireland, where it had great vogue formerly.

HURON, hū'rǒn, an Indian tribe. See Wyandot; Indians, American.

HURON, S. D., city and county-seat of Beadle County, on the Chicago and Northwestern and Great Northern railroads; also on the proposed line of the Duluth, Huron and Southern Railroad. Located at the centre of population for the State. Huron is surrounded by rich, fertile farms producing corn, alfalfa, hogs and cattle, also some dairy products and small grain. The city is a distributing point of considerable importance, being the division point of the Chicago and Northwestern roads going in all four directions, and is the home of the State Fair. Huron College, one of South Dakota's leading colleges, having $500,000 endowment, is also located here. Huron has commission form of government. Pop. 6,112.

HURON, Lake, one of the Great Lakes on the boundary between the United States and Canada. Canada is on the north and east, Canada and Michigan on the south and Michigan on the west. It receives the waters of Lake Superior through the Saint Mary's River, and the waters of Lake Michigan through Straits of Mackinac, and discharges its waters through Saint Clair River into Lake Saint Clair (q.v.). Its general direction is northwest and southeast. It length is about 250 miles, its average width about 155 miles and its area 22,322 square miles. This area includes Georgian Bay and North Channel. It is 581 feet above the sea, the same as Lake Michigan, 21 feet below the level of Lake Superior. The depth of the waters beyond the land shelf is from 200 to 750 feet; and along the coast, from 20 to 60 feet. The waters of the whole lake are remarkably clear, and in the northern part cold. In summer the temperature of the surface varies from 52° to 58° and of the bottom from 42° to 52°.

The chief arm of the lake on the east coast is Georgian Bay, which indents Ontario; and on the west, Saginaw Bay, in Michigan. Other indentations on the west coast are Thunder, Presque Isle and Hammond bays. A number of short streams flow into the lake from Michigan, the largest of which are Thunder Bay, Au Sable and Black rivers. The lake receives from Canada a large amount of water from lakes Nipissing, Simcoe, Muskoka, and several other small bodies which discharge their waters through short rivers into Georgian Bay.

There are no large islands in the main body of the lake, but on the north and northeast shores are a number of small islands, composed chiefly of glacial deposits and limestone. Grand Manitoulin and Cockburn islands, together with several small islands, belong to Canada. Drummond, Mackinac and Bois Blanc islands belong to the United States. The long group of islands in the northeast are separated from the mainland of Ontario by North Channel. The greater part of the shore line is low and at one time the country on the west was well wooded. Regular terraces showing different water levels, deposits of fine sand and clay containing freshwater shells, extend inland fully 20 miles and at heights above the lake to 100 and 200 feet. These wide beaches show that at one time this lake, as the other lakes, must have been much larger than at present. The area of the whole basin of the lake, including the surface of the water, is about 74,000 square miles. Some picturesque cliffs along the southeastern coast rise to a height from 80 to 150 feet. The harbors are nearly all protected by breakwaters. The chief ports on the west coast are Cheboygan, Alpena, Tawas City, Bay City (at the head of Saginaw Bay) and Sandbeach. Mackinaw and

Saint Ignace, at the entrance to the Straits of Mackinac, are important ports. A railroad line from Detroit to Mackinaw is almost parallel with the west coast. There is an abundance of fish in this lake; one kind, the whitefish, is most important.

Violent storms, to which the lake is subject, make navigation dangerous. During the summer months, from the first of May to December, there are but few storms. Lake Huron as a factor in commercial enterprises is most important; it is one of the great waterways of the world, and the shipping on its waters is growing in amount and importance. The great bulk of the iron ore from the Lake Superior district is now brought to the Cleveland and Pittsburgh districts; the wheat and flour from the Northwest comes east, and nearly all are carried over Lake Huron; and a large proportion of the products of the East which are sent to the Northward pass over this same lake. The Saint Mary's Falls Canal, «The Sault or 'Soo' Canal,» has been the means of greatly increasing the travel and traffic on Lake Huron.

As early as the 17th century this lake was crossed by the French missionary, Père Marquette, who, in 1668, established a mission at Sault Sainte Marie, Saint Mary's Falls. In 1673 he was in charge of the mission at Mackinaw, from which place, on 17 May 1673, he departed with Joliet and others in search of the «Big River.» For amount of shipping and tonnage see GREAT LAKES. Consult Morton, E. P., 'Lake Huron and the Country of the Algonquins' (Chicago 1913).

HURONIAN SERIES, the name first given by Sir William Logan to a series of strata lying in the vicinity of Lake Huron. They are very thick and consists chiefly of quartzite with great masses of greenish chloritic schist, sometimes containing pebbles derived from the Laurentian rocks. No organic remains have yet been found in them, and limestones are subordinate. They lie unconformably on the Laurentian. As the term is now used, the Huronian makes up the lower part of the Algonkian system and is divided into Lower, Middle and Upper Huronian. The latter is also called Animikean. The Middle Huronian contains the important iron ores of the Marquette Range in Michigan, and the Upper Huronian is the ore horizon of the Mesabi Range in Minnesota. The Lower Huronian conglomerates of Ontario are believed by many to be of glacial origin, as indicated by striated boulders within the main mass of the rock. If so, it is the earliest record we have of glaciation during the great geologic past. See GEOLOGY.

HURRICANE. See CYCLONE; STORMS; TORNADO; TYPHOONS.

HURRICANE CLIFFS. See GRAND WASH CLIFFS.

HURST, hėrst, **Hal,** English artist: b. London, 26 Aug. 1865. He started on his artistic career by drawing eviction scenes in Ireland. He emigrated to the United States, and joined the staff of the Philadelphia *Press;* afterward at New York, Paris and London he contributed to various journals and periodicals. He became a painter, studying at the Art League in New York and under Julian at Paris. Among his paintings are 'The Siren' (1896); 'The Capture' (1898); and 'The First Court of King Edward VII.'

HURST, John Fletcher, American Methodist bishop: b. near Salem, Md., 17 Aug. 1834; d. Washington, D. C., 4 May 1903. He was graduated from Dickinson College, Carlisle, Pa., in 1854, studied theology at Halle and Heidelberg, Germany, and after holding pastorates in New Jersey and Staten Island became bishop in 1880, and chancellor of the American University 1891–1902. He was one of the leading men in his denomination and of much prominence as a writer. Among his many works may be cited 'Literature of Theology'; 'History of Rationalism' (1865); 'Martyr to the Tract Cause' (1873); 'Life and Literature in the Fatherland' (1874); 'Outline of Church History' (1875); 'Our Theological Century' (1876); 'Bibliotheca Theologia' (1883); 'Short Histories of the Church' (1888–90); 'Short History of the Christian Church'; 'Indika: the Country and People of India and Ceylon' (1891); 'History of the Christian Church' (1897); 'History of Methodism' (1904). Consult the 'Life,' by Osborn (1905).

HUS, John. See HUSS, JOHN.

HUSBAND AND WIFE. The legislation of the past 50 or 60 years, beginning with the Married Woman's Property Acts of the 40's in the last century, have profoundly affected the rights and obligations of the parties to a marital contract, with respect to each other as well as with respect to the world at large. But the new legislation has been of the greatest diversity in character so that it is impossible to make a statement of the law that will exactly fit every locality. Moreover, the general rule that a statute does not abrogate the common law, unless such is clearly and irrefragably the intent thereof, makes a knowledge of the antecedent legal rules essential to an understanding of those which have superseded them in whole or in part. It is the duty of husband and wife to adhere to the marriage contract and cohabit; the husband having the right to determine the place of domicile. If he changes the same the wife must go with him; though in this country the husband is obliged to show a reasonable cause for removing to another abode in order to obligate the wife to follow him. The unreasonable refusal of the wife to follow would be an act of desertion. It is the duty of spouses by mutual forbearance to make a living together tolerable. Blackstone would find few subscribers nowadays to his dictum that a husband may correct his wife by subjecting her to restraint and even to «moderate» corporeal punishment. Such restraint and chastisement would have to be very moderate to satisfy modern ideas of ethical or legal propriety. On the other hand, if a wife is a woman of bad temper and provokes her husband's ill-usage, she will not be permitted by law to separate herself from his bed and board; «her remedy in such case is by bettering her own manners.» (Warring *v.* Warring, Haggard Consistorial Reports). If the husband drives his wife from his house by «conduct so abominable that no decent woman would live under the same roof with him,» her departure would not be desertion. Incontinence, of course, would justify the innocent party in leaving the guilty one, and no legal right would be forfeited in consequence of such departure.

Either spouse has a cause of action against any one who entices away or estranges the affections of the other. In England either the husband or the wife may bring suit against the other for a restitution of conjugal rights; actions of this character have not obtained judicial favor in this country, however.

At common law the husband was responsible for the torts of his wife even when committed before marriage. In theory of the law the husband stood in the position of a universal successor; having succeeded, on marriage, to all the rights of his wife, whether to things in possession or choses in action, he was assumed to have succeeded as well to her obligations, whether *ex delicto* or *ex contractu*. So the husband alone could proceed to recover damages for an injury suffered by his wife and was solely responsible for her torts during coverture. If the wife slandered another lady or horsewhipped a blackguard, the husband had to pay the damages. When a husband thus liable died, the right of action died with him and could not be pursued against the surviving widow or the husband's estate. Even for misdemeanors of a wife, not punishable by imprisonment, the husband alone could be held and prosecuted — and would be compelled to pay the fine. At the present time, and in nearly all jurisdictions, the husband's liability for the torts and misdemeanors of his wife is more narrowly circumscribed, and is limited to those committed in his presence; the presumption of law being that he coerced or commanded the wife to do what she did, or, at least, that he encouraged or connived in the wrong. The husband, however, can defend himself by showing the wrong to have been done by the wife against his will. As to higher crimes the complicity of the husband was also presumed from his presence. The suggestion, however, to absolve the wife from punishment for a felony committed presumptively under coercion from, or at the command of, the husband never found favor. When a married woman commits treason no presumption of coercive influence over her was deducible from her husband's participation in the crime, because the peculiar dangerousness of this offense to the state required from all persons connected with the act the fullest responsibility for their own part therein. Where a man and wife are charged with keeping a brothel, coercive influence from the husband will not be presumed, because in such a case «the wife probably would be the chief manager, and to hold her guiltless would be absurd.» The presumption of the guilt of the husband from his presence at the commission of a criminal act by the wife could always be rebutted, while, nowadays, his partnership in crime would have to be proven like that of any other accomplice. It was a general rule of the common law that husband and wife could not bear witness against one another in any action, civil or criminal. The rule was mandatory, not merely a rule of privilege — and was grounded on public policy, which would not be served by the disruption of conjugal relations and the disturbance of domestic tranquillity. From this rule an exception was again made in trials for high treason, in which either party to the marital contract could become a competent witness against the other; and where the testimony of the wife was of necessity required, as in the case of personal violence or cruel treatment charged against the husband, she would be a competent witness to prove the facts. In civil actions a wife might testify against her husband to anything she had done in the capacity of his agent. Modern legislation has brushed most of these disabilities and distinctions aside; and husbands and wives are permitted, and may be compelled, to testify against each other in nearly all kinds of legal proceedings. They are not competent witnesses in suits for divorce on the ground of adultery, nor in actions for criminal conversation, except to prove the fact of marriage. They are permitted but cannot be compelled to testify against each other in criminal actions; and they will neither be compelled nor permitted to disclose anything communicated in the confidence of the marital relation. A husband or wife giving harbor, aid and comfort to a spouse who has committed a crime does not thereby become an accessory after the fact. The duty of the husband to protect implies his right to defend the wife from personal injury; and a battery committed by either in defense of the other is not actionable.

It is the duty of the husband to support and maintain the wife as long as she lives with him. And from this duty the husband is not relieved, though the wife have independent means quite adequate to her needs. The obligation of the husband is to provide «necessaries,» and to obtain these the wife may contract debts which the husband by law is bound to pay. For more than 200 years the principal laid down in the leading case of Manby *v.* Scott — namely, that a husband is not bound by his wife's contracts, unless she acts by his authority — has controlled the decisions of the courts. The wife in the case had lived apart 20 years and returned; the husband had refused to receive her and forbidden tradesmen to trust her. The long separation countervailed any presumption of an authority conferred on the wife to contract even for necessaries. Such authority will be presumed to have been given only when the relations apparently are normal and the parties live together as husband and wife. But the fact of cohabitation as man and wife will not raise a presumption of the husband's assent to the purchase by the wife of non-essentials. This is illustrated by the triumphs over the Philistines of the gentleman who figured as defendant in the actions of Montagu *v.* Benedict, and Seaton *v.* Benedict, reported with much humor in Shirley's 'Leading Cases in Common Law.' Mrs. Benedict, who appears to have been a woman of extravagant tastes, contracted a substantial debt with the plaintiff, Montagu, for jewelry. In due course the jeweler presented a substantial bill, which Mr. Benedict declined to pay; and the court held that, «tradesmen, who are about to trust a married woman for what are not necessaries, ought in common prudence to inquire if she has her husband's consent for the order.» Mrs. Benedict continued to «walk on primrose path» and by the way dropped in at Seaton's millinery establishment, whence she took, with the gladly-given consent of the proprietress, large quantities of fine laces, scarves, gloves, etc., on the credit of her husband. The latter had always liberally furnished his wife with apparel or, what amounts to the same thing, with money to buy what she required, and he knew nothing of her clandestine dealings with Seaton. This person, confident in the correctness of her assumption that "a lady's needs" and "necessaries" were terms of identical meaning, brought suit when Benedict refused to pay the bill; but she met with a judicial rebuff, which gained nothing in sweetness from this judicial gloss to the decision: "It may be hard on a fashionable milliner, that she is precluded from supplying a lady without previous inquiry into her authority; the court, however, cannot inquire into these little delicacies, but must lay down a law that shall protect the husband from the extravagances of his wife." The rule deducible from these and many other cases is: When husband and wife are living together there is a presumption that the wife has the husband's authority to enter into contracts, binding on the latter, in relation to all domestic matters ordinarily entrusted to the woman of the house, and to obtain on the husband's credit the things necessary to the conduct of the household. The term "necessaries" means a reasonable supply of such goods and services as are suitable in kind, sufficient in quantity and required in fact, for the use of the husband, the wife, the children and other members of the household, according to the conditions in which they live. When the wife is living apart from the husband without his consent the presumption is the other way about — namely, that she has no authority to pledge his credit; and, when the separation is due to the woman's fault, the presumption of "no authority" is conclusive. When the separation is by mutual consent the wife goes forth with implied authority to contract for necessaries in the name of the husband. But this implication is not absolute and may be repelled by a variety of circumstances. For instance, if the husband make her an allowance which is sufficient, or accepted by her as sufficient; probably, also, if she have money of her own to live on, or if she be capable of earning it. For the wife's authority to bind the husband for necessaries is a mere question of agency, and an agency can hardly be assumed when the wife is living alone on her own income, or supported by her own earnings. The husband's liability to pay for necessaries cannot be evaded by a public, or even by personal notice not to extend credit, unless it can be shown also that the wife was adequately provided for by the husband. The latter must supply the wife's needs or pay. A married woman will not be permitted to suffer deprivation if there be a husband living capable of supplying her wants; and third parties may sell necessaries to her on credit — or lend her money to buy the same — and hold the husband responsible, though the latter have forbidden the wife to contract and the creditor have notice of the inhibition. (As to the effect of a divorce or judicial separation, see DIVORCE). A married woman living with her husband cannot be sued for debts contracted for necessaries. She incurs no liablity even when the necessaries are contracted for after the death of the husband in foreign parts, the fact of his demise being unknown.

In theory of the common law the personality of a woman, on her marriage, was merged in that of the husband. The twain had become one person with the husband as head. With respect to legal rights in property this merger was complete. The husband, on marriage, acquired absolute title of the wife's personal property, not held in trust; it became his as completely as if he had bought it, and could never again become hers, unless he gave it to her by will. In the event of the husband dying, without having made a will, the wife's personal property did not revert to her but went to his estate. Choses in action also passed to the husband, who alone could sue for a recovery. Unless the personal property of the wife was reduced to his possession during his lifetime, however, it remained her own, and would not pass to the husband's executors or administrators, nor become chargeable with the payment of his debts or legacies. On the death of the wife, however, the surviving husband was entitled to the administration of personal property that had remained in her possession, and he was unaccountable therefor to her next of kin. A gift or sale of personal property from the wife to the husband, or vice-versa, was a nullity, of course. The wife, in such case, would merely have transferred to the husband that which was already his; while he would immediately and again become the legal owner of the thing that had just been transferred to the wife. The wife, during coverture, gained nothing from her marriage so far as the personal property of the husband was concerned. In case of his death intestate, the wife surviving, she was entitled to one-third of his personal estate if there were children, or to one-half if there were none; but this right could be defeated by the testamentary disposition of the husband. Besides an absolute right to the personal property of the wife the husband, on marriage, obtained an usufructuary interest in all of the wife's real estate during the period of their joint lives; he was entitled to collect and use the rents and profits thereof. On the death of the wife, and if there had been any living children born of her husband, the latter became entitled to the possession, and the enjoyment of the income, for life of all his wife's real property (estate by curtesy) even though no child of the marriage survived. By no act of the wife could the husband's estate by curtesy be diminished or destroyed. A wife by her marriage acquired a right of dower. This was a life interest, to the extent of one-third of its value, in all real estate owned by the husband at the time of the marriage or acquired by him subsequently, whether by purchase, gift, inheritance or process of law. The right of dower could not be defeated by a conveyance of the property by the husband during the period of coverture nor by his will; and it attached to all real property owned by the husband at any time during his married life. The right of dower could be terminated only by a release from the wife; or the acceptance by her, in lieu of dower, of a provision made for her during his life, or by his will, out of the husband's individual estate. Dower could be admeasured, on the basis of its cash value as an annuity, and the owner of the right could thus be satisfied by a payment in gross. Conveyances of real estate from husband to wife and vice-versa, if direct and without intervention of a trustee, are void in law; though it has been held also that the effect of such a conveyance would be to create a joint estate for life, the surviving party taking the whole property on the death of the other.

While the common law rigorously adhered to the theory of the unipersonality of husband and wife, in equity the separate existence of the wife was abundantly acknowledged. She might own separate property, real as well as personal, free of any control on the part of her husband. Her right to the sole use and possession during coverture of property owned by her while single was usually effectuated by an ante-nuptual settlement; but property could also pass to her after marriage, for her sole and separate use, from any person and in any manner, by will, deed or gift — and it would be more absolutely her property than her husband's property was his. Sometimes the legal title to a married woman's separate estate was held by trustees, but the beneficiary of the "use" could dispense with her trustees' advice, manage the property as she pleased or convey or otherwise dispose of it without their knowledge or consent. Often "uses" were created without the formality of vesting the legal title in a trustee; and a single woman contemplating matrimony might convert her legal estate into a "use," and have the sole and separate management of the same after marriage. And this might be done on the very eve of the wedding, the only condition being that it was done with the knowledge and consent of the prospective husband. If done clandestinely it would be in fraud of his expectations, and the arrangement would be annulled by a court of equity. The rule of law that conveyances between husband and wife were nullities was disregarded in equity, and a husband's grants and gifts of either personal or real property to his wife for her separate use were validated. The legal disabilities of a married woman were considered non-existent in equity with respect to her separate estate. She was presumed to be clothed with all powers necessary to the management and protection of her property; she could sue and be sued without her husband joining or being joined in the action, and she could even enforce rights in opposition to him. In law a married woman could make no valid contract except for necessaries; in equity, and in respect to her separate property, a married woman's right of contract was not limited by any legal disability flowing from coverture.

The legal status of married women before the emancipatory legislation of the past half century was not quite as degraded as has sometimes been represented. The statutory changes are, to a large extent, matters of form. Under the statutes passed in the United States and in England, it is true, the husband, on marriage, acquires no rights whatever in the personal property owned by the wife at the time of marriage or acquired by her in any manner thereafter. It remains her separate property. But, as we have seen, even before the passage of this legislation both personal and real property could be owned separately by a married woman if she or her grantors and devisors took the precaution of converting it into a "use." Under the new law a man, on marriage, acquires no right in his wife's real estate during her lifetime; but he still has a life estate by curtesy which vests on the wife's death. Women, as before, acquire a right of dower in their husband's real estate when they marry; in this respect, as with respect to estates by curtesy, the law has not been altered. The wife, by her marriage, now acquires as little as she did under the old law with regard to the husband's personal property. If the husband dies intestate she gets one-third or one-half, or whatever share thereof the statutes of the State of her domicile may award her; if he chooses to make a will in favor of anybody else, even his "affinity," the widow has no remedy at law nor in equity. There is little comfort in the reflection that she fares neither better nor worse than her sisters of a by-gone age. The husband's right to administer a deceased wife's personal property and convert it to his own use may be defeated by a will. Moreover, there are statutes of distribution fixing the rights of the next of kin of an intestate wife. The American statutes uniformly permit married women to hold separate property and conduct business as "if they were unmarried." This, undoubtedly, marks a great advance over former conditions. Neither the common law nor equity recognized the right of a wife to her separate earnings. The husband was entitled to the wife's personal services and to the fruits thereof, and in theory this is still the case. It is so also in fact, except with respect to a wife's earnings in a business or profession separately conducted or practised by her, or where it is clearly intended that the earnings of the wife are on, and for, her own account. The right of a husband to recover damages for injuries suffered by his wife is based on the real or assumed loss of her services as the result of the injuries. Formerly she was incapable in law from prosecuting an action for tort. This disability has been removed, though in some jurisdictions the action must be brought jointly with the husband as her "next friend." In other localities husband and wife may each sue independently and recover damages for the same injury. The right now accorded to married women to conduct business in their own names and keep the earnings thereof is most valuable, pecuniarily as well as morally; it gives them a degree of independence far beyond that attainable in the marriage-settlement stage of civilization. The separate property held by married women in form of equitable "uses," after all, was merely a device for the idle rich. The New York Court of Appeals years ago regretted that the statutes, which granted married women the right "to hold separate property and conduct business as if unmarried," was not associated by the legislature with "the correlative rule that they have also capacity to contract debts as if unmarried." A married woman is still exempt from prosecution for any debt, unless it be contracted with respect to or for the benefit of her separate property, or in the conduct of her separate business. She would not be responsible for necessaries consumed in her household, though her earnings in business amount to 10 times those of her husband and her house were being conducted on a scale of living commensurate with her income rather than his. If she were dishonest enough to do so, she could repudiate her liability without fear of the law; the husband being still solely responsible for the supply of "necessaries." In the New York case above referred to a woman, known to have means, contracted in her own name for a large bill of goods, which she received and delivered to her husband to be used by the latter in his business. An action against her was dismissed, because the debt was not contracted by the wife in a business separately conducted by her, and her separate estate was not shown to have benefited by the transaction. This defect of the law has been remedied in many places. The English Married Woman's Property Act of 1870 laid down the more equitable rule, that the wife's separate estate is answerable for all debts contracted by her except as her husband's agent. To sum up the law, neither husband nor wife have any rights in the personal property of either that cannot be defeated at the caprice of the other; their interest in each other's real property is, an estate by curtesy to the husband if he survive, and a right of dower to the wife if she survive. Beyond this the wife has the right to be supported, which may be enforced either by the decree of an equity court for her separate maintenance, by actions in debt against the husband for necessaries, or by a quarter sessions court in a criminal proceeding for desertion. There remains to be mentioned the widow's right to her «paraphernalia.» This consists of clothing, bedding, furniture, jewelry and trinkets suitable to her condition; and this property forms a part of the husband's estate only in so far as it is chargeable for the payment of his debts if there is insufficient other property to pay the same. As against next of kin the paraphernalia belongs to the widowed wife.

Stephen Pfeil.

HUSBANDRY, Patrons of. See Grangers.

HUSH MONEY, a term used in English law, signifying a sum of money or its equivalent, given or offered to another in order to induce him to refrain from giving evidence or prosecuting an offense. Such a contract is not considered a penal offense at common law, but is illegal and cannot be enforced. The offense comes under the crime of compounding a felony and the punishment is imprisonment.

HUSHI, hoo'shē, Rumania, capital of the department of Falciu, near the Russian frontier, about 10 miles west of the Pruth, and 40 miles southeast of Jassy. An episcopal see, Hushi has an interesting 15th century cathedral and a theological seminary. There is active trade in cattle. Hushi was the seat of the Treaty of Pruth between Russia and Turkey in 1711. Pop. 15,500.

HUSI. See Hushi.

HUSKISSON, hŭs'kĭ-sŏn, **William,** English statesman and financier: b. Birch-Moreton, Worcestershire, 11 March 1770; d. 15 Sept. 1830. He was sent to Paris in 1783 to study medicine. In 1789 he became an enthusiastic sympathizer with the French Revolution, was present at the taking of the Bastille and joined the Club of 1789, instituted the following year. He made a speech at the club against the proposed creation of paper money, and withdrew from it when the assembly decreed the issue of assignats. His views of the Revolution afterward underwent a change. In 1790 he was appointed secretary to the British Ambassador; and when the Ambassador was recalled in 1792 he returned to England, and in 1795 he became Under-Secretary for War and the Colonies. In 1796 he was elected member of Parliament for Morpeth. He resigned in 1801, and returned in 1804. In Pitt's administration formed in this year he became Secretary of the Treasury, and during the Whig ministry that succeeded Pitt's death was an active member of the opposition. In 1807 he resumed his post as Secretary of the Treasury, which he resigned in 1809. In 1823 he was elected Member of Parliament for Liverpool, and appointed president of the Board of Trade and treasurer of the navy. From 1827 to 1828 he was Secretary of State for the Colonies. He was killed at the opening of the Liverpool and Manchester Railway, 15 Sept. 1830. He seldom spoke in Parliament except on commercial or financial subjects, on which he was an authority as also on subjects affecting India. He was a strong supporter of Catholic emancipation, and he anticipated Peel in his advocacy of a free-trade policy. Lord Melbourne regarded him as the greatest practical statesman he had known. A collective edition of his speeches and a memoir appeared in 1831.

HUSS, or HUS, John, Bohemian religious heresiarch: b. Husinec, Southern Bohemia, about 1369; d. Constance, Switzerland, 6 July 1415. He studied at the University of Prague and in 1398 began to lecture on theology and philosophy. In 1401 he was made dean of the faculty of philosophy, and was made rector of the university (1400). Since 1391 he had been acquainted with the writings of Wiclif, and his denunciations of the indulgences, of masses for the dead, of auricular confession, etc., alarmed Archbishop Stynko of Prague, who had 200 volumes of Wiclif's writings burned (1410) in the archiepiscopal palace, and the preaching of his doctrines in Bohemia prohibited. Huss appealed to the Pope, John XXIII, who summoned him to appear at Bologna. Huss refused to appear and was in consequence excommunicated, and Prague threatened with an interdict as long as Huss should remain in it. Wenceslas, the king, alarmed by this menace, thought to bring about peace; and at his demand, Huss made an orthodox profession of faith in 1411. But the quarrel broke out again when Huss and his friend Jerome publicly condemned the papal indulgences granted for the crusade against Ladislas of Naples. Huss was again excommunicated and Prague interdicted. He now retired to Husinec to the protection of his feudal lord and here he wrote his books 'On the Six Errors' and 'On the Church,' in which he attacks transsubstantiation, the belief in the papal primacy and the saints, the efficacy of the absolution of a vicious priest, unconditional obedience to earthly rulers, and makes the Scriptures the only rule in matters of religion. In the meantime the Council of Constance had convened in 1413. Huss was summoned to this council to render an account of his doctrines. The Emperor Sigismund granted him a safe conduct to the council. After several examinations of his doctrines, and his persistent refusal to retract the points which were regarded as heretical, he was sentenced to death and burned 6 July 1415. The Hussite War followed. See Hussites. The best editions of his works are by K. J. Erben (1865–68); F. Palacky (1869) and by W. Flojshaus (1904). Consult also Neander, J. A. W., 'Allgemeine Geschichte der christlichen Religion und Kirche' (Eng. trans. by J. Torrey, 1850–58); von Lechler, G., 'Wiclif und die Vorgeschichte der Reformation' (Eng. trans. by P. Lorimer, 1878); the 'Acta' of the Council of Constance (in P-Labbe, 'Concilia,' Vol. XVI, 1731). Good biographical material is contained in Denis, F., 'Huss et la guerre des Hussites' (1878); Lützow, F. H. H., 'Life and Times of Master John Hus' (New York 1909); Lea, H. C., 'History of the Inquisition' (Vol. VIII, New York 1888); Creighton, M., 'History of the Papacy' (1897).

HUSSARS, huz-zärz', light cavalry troops, originally raised by Matthias Corvinus in 1458 to fight against the Turks. Of the several possible origins suggested for the word, the most generally accepted is that it is derived from the Magyar word «husz,» meaning «twenty,» the troops having been raised by selecting every twentieth man in the community. The effectiveness of these light-mounted troops recommended their adoption by other European armies; and they became part of the British cavalry in 1805. The peculiar uniform of the Hungarian hussar with its characteristic loose coat, hanging from the left shoulder, was adopted with considerable modification by the other European light cavalry.

HUSSEIN KAMIL PASHA, hûs-sän kä'mel, first sultan of Egypt: b. Cairo, 20 Dec. 1853; d. there, 9 Oct. 1917. He was the second son of the Khedive Ismail and brother of the late Khedive Tewfik (d. 1892). The latter was succeeded by his son, Abbas Hilmi (q.v.), who reigned till 18 Dec. 1914, when the British government deposed him for having «adhered to the King's enemies,» namely, intriguing with Turkey and Germany. A British protectorate was proclaimed over Egypt and Hussein Kamil became sultan. After attending native schools he was sent to Paris in 1867 to complete his education. There he was the guest of the Emperor Napoleon III and the playmate of the ill-fated Prince Imperial, who was killed in the Zulu War, 1879. He accompanied his exiled father to Naples, but was permitted to return to Egypt in 1883. Fully appreciating the benefit of the British occupation to his country, he became strongly pro-British in sentiments and was a friend and adviser to Cromer, Gorst and Kitchener. Two attempts were made to assassinate him in 1915; in November a court-martial in Constantinople sentenced him to death for alleged treachery. He had gained a wide experience in administrative positions, personally attended to all public affairs and freely gave advice to all who sought it. He was twice married and had one son and four daughters. His youngest brother, Prince Ahmed Fuad (q.v.), succeeded him.

HUSSEIN NAZIM PASHA, Turkish general: b. Constantinople, 1848; d. 1913. After a preliminary education at native schools, he was sent to the military school at Saint Cyr, Paris. By successive steps he became chief of the Turkish staff during the war with Russia. His sympathies were completely with the revolutionary element in Turkey and this brought him into conflict with the government repeatedly. He was thrown into prison for a five-year sentence, but managed to escape, and, joining the Young Turks, took an active part in planning the Revolution of 1908. His skill recommended him to the royal party and in 1909 he was appointed Minister of War under Kiamil Pasha. Under threat by the Young Turks he was forced to withdraw. He subsequently served as Vali at Bagdad, where he proved himself a capable and efficient governor; was made chief of the army council in 1911 and Minister of War under Mukhtar Pasha. During the Balkan War he distinguished himself by the vigor and brilliance of his moves. His early adherents, the Young Turks, assassinated him in 1913.

HUSSITES, followers of the Bohemian reformer and martyr John Huss (q.v.), who to avenge his death on the treacherous Emperor Sigismund and the clergy involved the empire in one of the most terrible wars of history (1420–34). Instead of suppressing the teachings of Huss, the auto-da-fé of Constance was the slogan of union for multitudes of all classes, including a league of 450 Bohemian nobles. Their symbol was the chalice, the withdrawal of which in the celebration of the Lord's Supper had been a cause of contention. The wavering and temporizing King Wenceslas was compelled in 1417 to grant the use of many churches for the celebration of the sacrament in both forms. After his death, 13 Aug. 1419, the inquisitorial violence of the cardinal legate, John Dominico, kindled the fire of insurrection. The people could not overthrow the claims of the hated Emperor Sigismund to the vacant throne and, bent upon the extirpation of so-called heresy, faithless in treaties, but unequal to contend with the activity of the Hussites and the genius of their generals Ziska and Procopius, for 15 years Sigismund saw his kingdom in a state of utter anarchy. The Hussites comprised three parties (a) Calixtines or Utraquists (q.v.); b. Orphans; and (c) Taborites. Overtures tending to conciliation were made by the Council of Basel in 1431 which were listened to by the Calixtines who were desirous of peace. On 20 Nov. 1433 the compromise or compact of Prague was made, which, however, was not accepted by all parties and hostilities recommenced, but ended by a complete victory of the Calixtines and Catholics under Meinhard of Neuhaus, at Böhmischbrod, 30 May 1434. The Orphans and Taborites deprived of political influence and religious freedom finally merged in the fraternity of Bohemian and Moravian Brethren (q.v.), which arose in 1457. Consult Berger, W., 'Johannes Hus und König Sigmund' (1871); Denis, E., 'Huss et la guerre des Hussites' (Paris 1878); Krummel, L., 'Geschichte der böhmischen Reformation' (Gotha 1866); ib., 'Utratisquen und Taboriten' (Gotha 1871); Lötzone, Count, 'The Life and Times of John Hus' (London 1909).

HUSTING, the name applied to an ancient court held in the city of London. It was the County Court and listened to pleas of land, common pleas and appeals from sheriffs. The court in its original sense no longer exists, although a hustings court is sometimes held for registering gifts to the municipality. In its present sense, the word denotes the place where members of Parliament used to be nominated, before the Ballot Act of 1872 rejected the form of nominating openly. From this it has come to be applied to any electioneering platform. In the United States a hustings court existed in many towns in Virginia which were settled during the 18th century. The establishment of such a court is recorded in the charters of Norfolk and of Richmond.

HUTCHESON, Francis, Irish philosopher: b. Drumalig, Ireland, 8 Aug. 1694; d. Glasgow, 8 Aug. 1746. He was educated at the University of Glasgow, taught in Dublin 1717–29, and in 1729 became professor of philosophy at Glasgow. In 1725 the first edition of his celebrated 'Inquiry into the Ideas of Beauty and Virtue' appeared without his name. In 1728 he published his 'Treatise on the Passions,' often reprinted and admired even by those who dispute the soundness of its philosophy. In 1775 was published from his MSS. a 'System of Moral Philosophy.' The philosophy of Hutcheson is based primarily on that of Locke. His particular theory of conscience as a distinct sense was attacked by Richard Price in a celebrated work, 'Principal Questions and Difficulties in Morals.' The views of Hutcheson and Price are reviewed in Jouffroy's 'Cours de droit naturel.' Hutcheson was a writer of considerable originality who stimulated the spirit of inquiry in Scotland and is justly regarded as the precursor of Reid and the founder of the Scottish school in philosophy. An admirable résumé of his works is contained in Cousin's 'Philosophie Ecossaise.' Consult Albee, 'History of English Utilitarianism' (1902); Scott, 'Francis Hutcheson' (1901).

HUTCHINS, Harry Burns, American university president: b. Lisbon, N. H., 8 April 1847. He received his education at the University of Michigan, where he subsequently became assistant professor of history and rhetoric (1872–76), Jay professor of law (1884–87). He then was called to the chair of law at Cornell University, remaining until 1894. In the following year he resumed his connection with the University of Michigan, serving as professor of law, dean of the law department (1895–1910), acting president (1897–98), and from October to June 1910, on which latter date he became president. Dr. Hutchins received the degree of LL.D. from the University of Wisconsin (1897), Wesleyan (1916) and Notre Dame (1917). He is also a member of the advisory board of the *Michigan Law Review* and has revised and annotated, under appointment from the Supreme Court, five volumes of 'Michigan Supreme Court Reports.' He also edited the American edition of Williams' book on 'Real Property,' was consulting editor of 'American and English Encyclopedia of Law and Procedure,' and contributor of the biography of Thomas M. Cooley to the 'Great American Lawyers' series. He was appointed a member of the international commission created by the treaty between the United States and Uruguay for the advancement of peace.

HUTCHINS, Thomas, American geographer: b. Monmouth, N. J., 1730; d. Pittsburgh, Pa., 28 April 1789. In early life he enlisted in the English army and saw active service in the French and Indian War. He was in England in 1779 and was arrested in London and thrown into prison as an advocate of American independence. He escaped to France, from which country he sailed to America, joined the Continental army and was appointed geographer-general by General Greene. Among his published works are 'Topographical Description of Virginia, Pennsylvania, Maryland and North Carolina' (1778); 'History, Narrative and Topographical Description of Louisiana and Western Florida' (1784).

HUTCHINSON, Anne, American religious leader, the founder of the Antinomian party in the New England colonies: b. Lincolnshire, England, about 1590; d. Westchester County, N. Y., August 1643. She was the daughter of a Lincolnshire clergyman. In England she was interested in the preaching of John Cotton and her brother-in-law, John Wheelwright, and it was her desire to enjoy the ministry of the former which induced her to follow him to New England. She arrived in Boston with her husband 18 Sept. 1634, was admitted a member of the Boston church 2 November and rapidly acquired esteem and influence. She instituted meetings of the women of the church to discuss sermons and doctrines, in which, with a ready wit, bold spirit and imposing familiarity with the Scripture, she gave prominence to peculiar speculations which even on her voyage had attracted the attention and caused the displeasure of her fellow passengers. Such were the tenets that the person of the Holy Spirit dwells in every believer and that the inward revelations of the Spirit, the conscious judgments of the mind, are of paramount authority. She had been two years in the country before the strife between her supporters and her opponents broke out into public action. Among her partisans were the young governor, Vane, Cotton, Wheelwright and the whole Boston church with the exception of five members, one of whom was the associate pastor, Wilson, while the country clergy and churches were generally united against her. «The dispute,» says Bancroft, «infused its spirit into everything; it interfered with the levy of troops for the Pequot War; it influenced the respect shown to the magistrates, the distribution of town lots, the assessment of rates; and at last the continued existence of the two opposing parties was considered inconsistent with the public peace.» The peculiar tenets of Mrs. Hutchinson were among the 82 opinions condemned as erroneous by the ecclesiastical synod at Newtown 30 Aug. 1637; and in November she was summoned before the general court and after a trial of two days sentenced, with some of her associates, to banishment from the territory of Massachusetts, but was allowed to remain during the winter at a private house in Roxbury. She joined the larger number of her friends, who, led by John Clarke and William Coddington, had been welcomed by Roger Williams to his vicinity, and had obtained through his influence from the chief of the Narragansetts the island of Aquidneck, subsequently called Rhode Island. There a body politic was formed on democratic principles, in which no one was to be «accounted a delinquent for doctrine.» The church in Boston, from which she had been excommunicated, vainly sent a deputation of «four men of a lovely and winning spirit» to the island with the hope of reclaiming her. After the death of her husband in 1642 she removed with her surviving family into the territory of the Dutch, probably from apprehensions that Rhode Island might not be a safe place of refuge from the encroachments of Massachusetts. The precise locality where she settled has been a matter of dispute, but according to the latest authorities it was near Hell Gate, Westchester County, N. Y. The Indians and the Dutch were then at war and in an invasion of the settlement by the former her house was attacked and set on fire and herself and all her family, excepting one child who was carried captive, perished either by the flames or by the weapons of the savages. Consult the biography by Jared Sparks in the ‘Library of American Biography,’ (Vol. XVI, 1845).

HUTCHINSON, Horatio Gordon, English golfer: b. 16 May 1859. He was educated at Charterhouse School, London, and graduated with classical honors in the University of Oxford. He was golf champion in England 1886–87. He has published ‘Hints on Golf’; ‘Golf’ (in Badminton Library); ‘Creatures of Circumstance’; ‘Peter Steele the Cricketer’; ‘My Wife's Politics’; ‘Cricketing Laws and Stories’; ‘The Book of Golf and Golfers’ (1899); ‘Little Lady Mary’ (1900); ‘Dreams and Their Meanings’; ‘A Friend of Nelson’ (1902); ‘Bert Edward, the Golf Caddie’ (1903); ‘Glencairly Castle’ (1904); ‘Amelia and the Doctor’ (1906); ‘A Saga of the Sunbeam’ (1910); ‘The Faun and the Philosopher’ (1915); ‘From Doubt to Faith’ (1916).

HUTCHINSON, John, Puritan English soldier: b. Nottinghamshire, 1615; d. Sandown castle, Kent, 11 Sept. 1664. While a student of law, being of a religious turn of mind, he devoted much time also to the study of divinity, from which his attention was soon diverted by the serious political questions which agitated the kingdom. A careful investigation of the matters at issue between the king and the Parliament satisfied him of the justice of the latter's cause and after the commencement of the Civil War he declared for the Parliament and was appointed governor of Nottingham castle, which he held until the close of the war. He afterward represented Nottingham in Parliament, and as a member of the high court of judiciary appointed for the trial of the king concurred in the sentence pronounced on him. The subsequent course of Cromwell, however, met with the disapproval of Hutchinson. At the restoration he was comprehended in the general act of amnesty, but was subsequently arrested on a suspicion of treasonable conspiracy and after a detention of 10 months in the Tower was removed to Sandown castle, where he died of fever.

HUTCHINSON, John, English philosopher, founder of a mystical school of philosophy and theology: b. Spennithorne, Yorkshire, 1674; d. 28 Aug. 1737. In 1724 appeared the first part of his ‘Moses' Principia,’ in which he disputed the Newtonian theory of gravitation. In the second part (1727) he continued his criticisms of Newton and maintained on Biblical authority the doctrine of a *plenum* in opposition to that of a *vacuum*. From this time one or more volumes, containing a sort of cabalistic interpretation of the Hebrew Scriptures, appeared annually. His leading idea is that the Scriptures contain the elements of all rational philosophy as well as of general religion. The Hebrew language has not only its literal but its typical sense, every root of it being significant of hidden meanings. With this elastic principle of exegesis he deduces a system from which the occult powers of attraction, gravitation, magnetism and electricity are excluded, but according to which the whole mechanism of the heavens is the result of the agency of fire, light and spirit, the three material elements which were set to work in the beginning and which typify the three persons of the Trinity.

HUTCHINSON, Thomas, American colonial governor: b. Boston, 9 Sept. 1711; d. Brompton, near London, 3 June 1780. He was the son of a merchant of Boston who was long a member of the council, and graduated at Harvard College in 1727. He represented Boston for 10 years in the general court, of which he was for three years speaker; became judge of probate in 1752, was a councillor from 1749 to 1766, lieutenant-governor from 1758 to 1771, and appointed chief justice in 1760, thus holding four high offices at one time. In the disputes which led to the Revolution he sided with the British government; but he favored a moderate policy. His brother-in-law, Andrew Oliver, was appointed distributor of stamps under the law which was to go into effect 1 Nov. 1765, but was compelled by mobs to resign the office before that time. The mansion of Hutchinson was also twice attacked in consequence of a report that he had written letters in favor of the act, and on the second occasion (26 August), when the rioters were maddened by liquor, his house was sacked, the furniture burned in bonfires in the street and many manuscripts relating to the history of the province, which he had been 30 years in collecting and which could not be replaced, were lost. The inhabitants of the town on the following day in public meeting voted their abhorrence of the proceedings; but though many of the actors were well known, no one was punished. He, however, received compensation for his losses. When in 1769 Governor Bernard was transferred to Virginia, the government of Massachusetts fell to Hutchinson. The popular excitement had already been increased by the arrival of the British troops, and after the so-called Boston massacre a committee of citizens, headed by Samuel Adams, obliged him to consent to the removal of the regiments. The popular indignation against Hutchinson became so great that he at last obtained leave of absence and sailed for England, 1 June 1773. The Privy Council investigated his official acts, and decided in favor of “his honor, integrity, and conduct,” which decision was approved by the king. He was rewarded with a pension. He published ‘History of the Colony of Massachusetts Bay, from the First Settlement Thereof, in 1628, until the Year 1750’ (2 vols., 1760–67; Vol. III, 1828); ‘Brief State of the Claim of the Colonies’ (1764); ‘Collection of Original Papers Relative to the History of the Colony of Massachusetts Bay’ (1869). His diary and letters appeared (1883–86). The sober judgment of later times has reversed the prejudiced accusations of his American contemporaries, and he is now seen to have been a conscientious man, zealous in the performance of duty but sorely perplexed between the claims of loyalty to the king and his natural inclinations in favor of the colony. Consult Hosmer, 'Life of Thomas Hutchinson' (1896); Fiske, 'Historical Essays' (Vol. I, 1902).

HUTCHINSON, Kan., city and county-seat of Reno County, on the Arkansas River, and on the Atchison, Topeka and Santa Fe, the Chicago, Rock Island and Pacific, the Hutchinson and Southern and the Missouri Pacific railroads, 40 miles west of Wichita. The city, founded in 1871, has one of the largest salt interests in the world, producing about 6,000 barrels per day. It is also an important meat packing and shipping centre; and has manufactures of lumber, machinery, boilers, etc., and the railroad shops of the Hutchinson and Southern Railroad. It has a public library, high school, State reformatory, electric lights, a national bank and an assessed property valuation of $1,500,000. The commission form of government has been in operation since 1909. Pop. 19,500.

HUTIA, a West Indian rodent. See RODENTIA.

HUTSON, Charles Woodward, American educator and author: b. McPhersonville, S. C., 23 Sept. 1840. He was graduated from South Carolina College in 1860; served in the Confederate army 1861–65; was professor of Greek in Louisiana State University, 1869–73; of modern languages in the University of Mississippi 1881–89, and of English and history in the Texas Agricultural and Mechanical College 1893–1908. South Carolina University, his alma mater, conferred on him the LL.D. degree in 1911. He has published 'Out of a Besieged City' (1887); 'The Beginning of Civilization' (1888); 'The Story of Beryl' (1888); 'French Literature' (1889); 'The Story of Language' (1897); two articles in 'The South in The Building of The Nation' (1909), and edited Lafcadio Hearn's 'Fantastics' (1914).

HUTTEN, hoot'tĕn, **Philip von,** German adventurer; cousin of Ulrich von Hutten (q.v.): b. Birkenfeld, about 1490; d. Venezuela, 1546. In 1528 the Emperor Charles V made a grant of the province of Venezuela to the Welsers, a firm of Augsburg merchants; and Hutten sailed with one of the companies sent out by them. He accompanied the viceroy, Georg Hohemut, in a journey (1536–38), in which they reached the headwaters of the Rio Japura, near the equator. In 1541 he set out in search of the Golden City. After several years of wandering, harassed by the natives and weakened by hunger and fever, he and his followers came on a large city, the capital of the Omaguas, in the country north of the Amazons, where they were routed by the Indians, and Hutten himself severely wounded. He led those of his followers who survived back to Coro in 1546, where Juan de Caravajal had in the meantime usurped the office of viceroy; and by him Hutten and his lieutenant, Bartel Welser, were seized and beheaded. Eight years later the Welsers' grant was taken from them, and the German rule in Venezuela was concluded. Hutten left an account of his journeyings, which was published under the title 'Zeitung aus Indien' (1765). Consult Von Langegg, 'El Dorado' (1888).

HUTTEN, Ulrich von, ool'rĭн fōn, German knight, distinguished for his poems and satires, and for the influence which his writings exercised upon the Reformation: b. Steckelberg on the Main, 21 April 1488; d. Ufnau, an island in the lake of Zürich, 23 Aug. 1523. His father placed him at Fulda in order to educate him for a monk. The monastic school there was one of the most famous in all Germany, and he received an excellent education. Here he lost his faith and, the declared enemy of Christianity, fled to Erfurt in 1504, where he became intimately acquainted with several scholars and poets. In 1511 he went to Wittenberg, where he published a work on versification. Ulrich, Duke of Würtemberg, murdered a cousin of Hutten and Hutten gave free course to his indignation in poems, letters and addresses, which made him known throughout Germany. He distinguished himself no less in the Reuchlinian controversy with the Dominican Hogstraaten in Cologne. Hutten severely criticized the monastic life, and was so much the enemy of the clergy, that by his edition of Laurentius Valla, 'De falso credita et ementita Donatione Constantini,' he declared war upon the Church and prepared the way for Luther. In 1518 he entered the service of Albert, archbishop of Mayence, and made several official journeys to Paris. He also accompanied the archbishop to the Diet at Augsburg, where Luther held his well-known discussion with Cajetan; and Hutten, in a Demosthenic oration, urged the German princes to a war against the Turks. He took the field with the Swabian League in 1519 against his hereditary enemy, Ulrich of Würtemberg, and then retired to the solitude of his paternal castle of Steckelberg, to engage anew in the controversy with the monks. Here he published work after work, violently assailing the Church, the clergy and the state. Leaving Steckelberg in 1522 he went first to Basel and thence to Zürich, where he died. He was a savage and violent controversialist, and was unsparing in the vehemence of his invective. Consult 'Life' by Jordan (1910); and Sturges' translation of Strauss' 'Life' in German.

HUTTON, hut'n, **Charles,** English mathematician: b. Newcastle-upon-Tyne, 14 Aug. 1737; d. 27 Jan. 1823. The destruction of the old bridge at Newcastle having attracted his attention to the subject of the construction and properties of arches, he was led to the production of a small work on the 'Principles of Bridges' (1772), which laid the foundation of his future fame. He was in 1773 appointed professor of mathematics at Woolwich Academy, elected a Fellow of the Royal Society in 1774 and in 1785 published his 'Mathematical Tables,' preceded by an introduction, tracing the progress and improvement of logarithms from the date of their discovery. In 1778 he had gained the Copley medal for investigations on ballistics. At the request of the Royal Society, he carried out investigations concerning the density and mass of the earth. From 1779 to 1783 he was foreign secretary of the Royal Society. On account of ill health he resigned his chair in 1807, receiving a pension of £500 a year. From 1774 to 1817 he edited the *Ladies Diary*. Later works were 'Tracts, Mathematical and Philosophical' (1786); 'Elements of Conic Sections'; 'Mathematical and Philosophical Dictionary' (1795–96); 'Course of Mathematics' (1798–1811).

HUTTON, Edward, English author: b. London, 12 April 1875. He became deeply interested in the literature and art of Italy, and spent several years traveling through that country and through Spain on foot. He is the author of a number of well-known books relating to his studies there. Among these may be mentioned 'Frederic Uvedale: A Romance' (1901); 'Italy and the Italians' (1902); 'Studies in the Lives of the Saints' (1902); 'The Cities of Umbria' (1905); 'The Cities of Spain' (1906); 'Sigismondo Malatesta' (1906); 'Florence and Northern Tuscany' (1907); 'County Walks about Florence' (1908); 'In Unknown Tuscany' (1909); 'Giovanni Boccaccio' (1909); 'Rome' (1909); 'Siena and Southern Tuscany' (1910); 'Venice and Venetia' (1911); 'Highways and Byways in Somerset' (1912); 'The Cities of Lombardy' (1912); 'Ravenna' (1913); 'England of My Heart' (1914); 'Naples and Southern Italy' (1914); 'Attila and the Huns' (1915); 'Highways and Byways in Wiltshire' (1917). He edited also two extremely important works: Dennistoun's 'Dukes of Urbino' (3 vols., 1908); and Crowe and Cavalcaselle's 'History of Painting in Italy' (3 vols., 1908–09).

HUTTON, Frederick Remsen, American mechanical engineer, educator and author: b. New York, 28 May 1853. He graduated at Columbia University in 1873; was professor of mechanical engineering there from 1877 to 1907; and has been professor emeritus since 1907. He received the honorary degrees of Sc.D. from Columbia in 1904 and Rutgers College in 1914. He was secretary of the American Society of Mechanical Engineers 1883 to 1906, president 1907, honorary secretary from 1907; consulting engineer department of water, gas and electricity, New York city, 1911; consulting engineer and chairman Technical Committee of Automobile Club of America since 1911; general secretary National Highways Association; secretary Engineering Foundation 1915. A contributor to the leading encyclopedias he is also the author of 'Machine Tools' (United States Census 1880); 'Mechanical Engineering of Power Plants' (1897); 'Heat and Heat Engines' (1899); 'The Gas Engine' (1904).

HUTTON, James, Scottish geologist: b. Edinburgh, 3 June 1726; d. there, 26 March 1797. He studied medicine at Paris and Leyden, but on his return (1754) devoted himself to agricultural pursuits and to chemistry, from which he was led to mineralogy and geology. In 1768 he removed to Edinburgh, and there spent his time in scientific investigations. He was the first great British geologist, and the «originator of the modern explanation of the earth's crust by means of changes still in progress.» He published 'A Theory of the Earth' (1795) and 'A Theory of Rain' (1784); 'Dissertations in Natural Philosophy' (1792); 'Considerations on the Nature of Coal and Culm' (1777), and other works. See HUTTONIAN THEORY.

HUTTON, Lawrence, American editor and critic: b. New York, 8 Aug. 1843; d. Princeton, N. J., 10 June 1904. He was privately educated, for some time devoted himself to the study of literature and to foreign travel, in the early 70's became a dramatic critic, and began contributions to periodicals of many sorts. From 1886 to 1898 he was literary editor of *Harper's Magazine* and subsequently he became lecturer in English literature at Princeton University. He was a well-known collector, possessing among various things a famous series of death-masks of historical personages. He was also an organizer and founder of the Authors' Club and of the American Copyright League. Among his numerous writings were 'Plays and Players' (1875); 'Literary Landmarks' of famous cities (1885–1904), etc. Consult Wood, 'Lawrence and Eleanor Hutton: Their Books of Association' (1905).

HUTTON, Maurice, Canadian educationist: b. Manchester, England, 1856. He was educated at Magdalen College School and Worcester College, Oxford, and was a Fellow of Merton College, Oxford, 1879–86. In 1880 he was appointed lecturer on classics and ancient history in Firth College, Sheffield, was professor of classics in University College, Toronto (1880–87), and from the latter year has held the chair of Greek in that university, and became principal in 1901. He has published several translations from the classics and articles on Herodotus and Thucydides.

HUTTON, Richard Holt, English essayist and journalist: b. Leeds, 2 June 1826; d. Twickenham, 7 Sept. 1897. The son of a Unitarian clergyman, he was educated at University College, London, and in Germany, for the Unitarian ministry, but, coming under the influence of F. D. Maurice, he entered the Anglican Church. In 1861 he became editor of the *Spectator* which owed its prominence largely to him. Through this journal he exercised great influence on the thought, political and religious of his time. During the American Civil War he incurred great hostility and ventured the fortunes of his paper by a strenuous advocacy of the cause of the North. Up till the time of the Home Rule split (1886), he supported the Liberal party. Hutton's best work is in the critical 'Essays, Theological and Literary' (1871); 'Essays on Some Modern Guides of English Thought' (1887); in the biography of Sir Walter Scott in the 'English Men of Letters' (1878); and 'Aspects of Religious and Scientific Thought' (1899). Consult Hogben, 'R. H. Hutton of the Spectator' (1900).

HUTTONIAN THEORY, a view of geological processes first published by James Hutton (q.v.) in 1788, in his 'Theory of the Earth,' and developed in 1795. He was the first to distinguish between cosmogony and geology, believing the latter to be in no way concerned with «questions as to the origin of things.» His view was that the upraised land of the globe must be worn away by atmospheric influences and the débris be finally deposited in the bed in the sea, where it is consolidated under great pressure; it is then forced upward by subterranean heat, acting with an expansive power, and thereby split and cracked, the fissures at the same time filling with molten mineral matter; and so the process goes on. Hutton was the precursor of Sir Charles Lyell, whose views were essentially the same, and who procured for them large acceptance among geologists. See UNIFORMITARIANISM.

HUXLEY, Thomas Henry, English biologist: b. Ealing, Middlesex, England, 4 May 1825; d. Eastbourne, Sussex, 29 June 1895. When he was 12 or 13, he wished to become a mechanical engineer; but a medical brother-in-law (Dr. Salt) took him in hand, and he commenced at this early age the study of medicine. Eventually he went to Charing Cross Hospital, and passed the first M.B. examination of the University of London. Stern necessity compelled him, as soon as his medical course was over, to seek at once, even before he was of age, some post or employment. At the suggestion of a fellow-student, Huxley in 1846 applied for admission to the medical service of the navy, was admitted and was in attendance at the naval hospital at Haslar. The next year he was appointed assistant-surgeon of the *Rattlesnake*, which was sent on an exploring and surveying cruise in the seas on the east and northeast of Australia. The voyage lasted four years and gave Huxley an opportunity of gaining an almost unrivaled knowledge of marine zoology. Various papers on this subject were contributed by him to the Linnæan and the Royal Society (one of them gaining a medal from the latter body, of which he was elected a member in 1851), and a further result of his investigations was the important work published in 1859, entitled 'The Oceanic Hydrozoa.' He suggested the homology between the germinal layers of a vertebrate embryo and the two layers of a medusa.

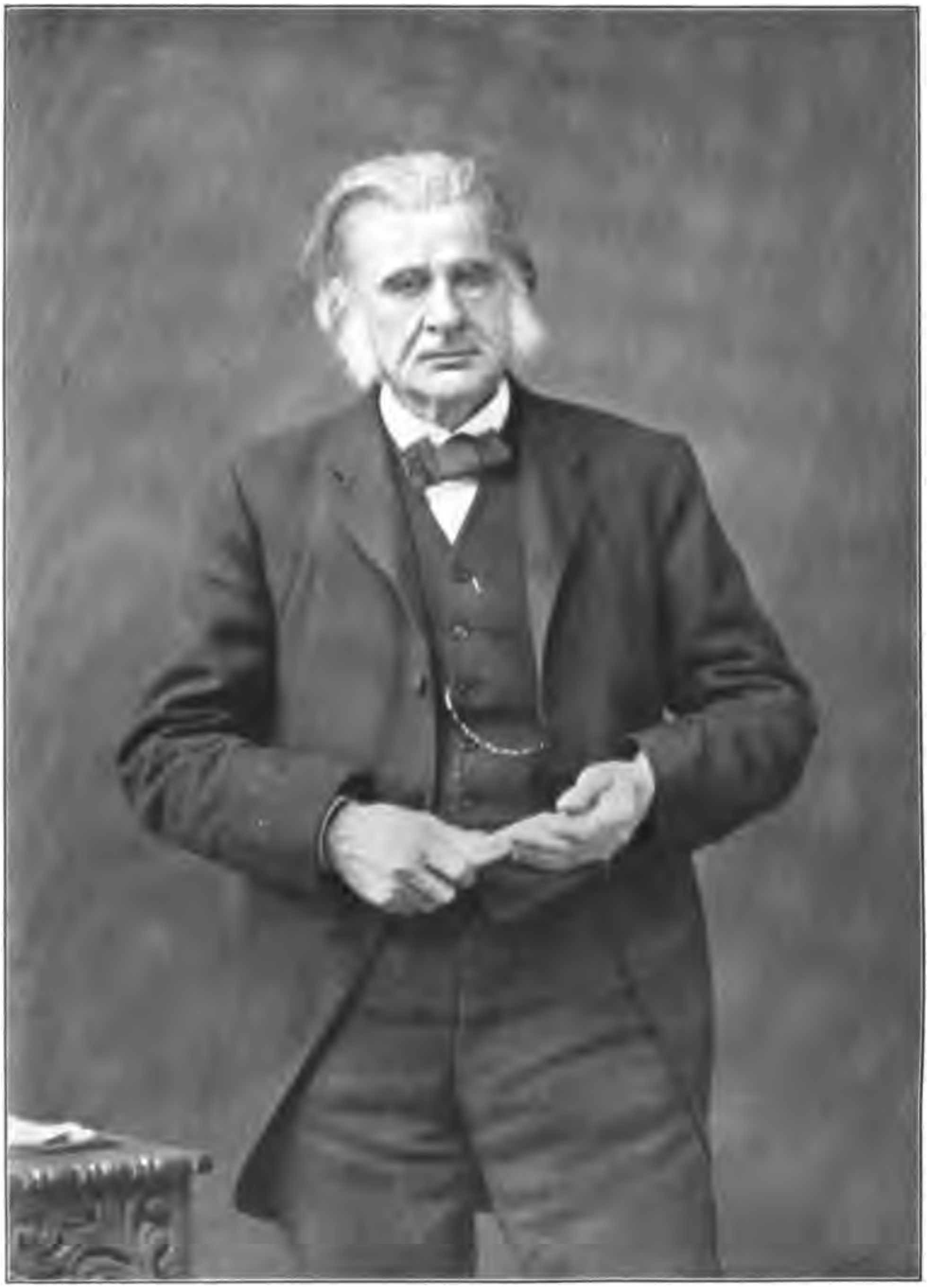
The *Rattlesnake* returned to England at the end of the year 1850 and Huxley found that the scientific papers he had sent home had already made him famous. By the aid of those who valued the promise given by his published work, he was allowed by the Admiralty for three years to draw pay as a navy surgeon while devoting himself to the working up of the results of his observations when at sea. In 1854 he was appointed lecturer or professor of natural history in the Royal School of Mines, a post long combined with that of naturalist to the Geological Survey. In 1855 he was appointed Fullerian professor of physiology to the Royal Institution, and delivered four courses of lectures in as many years; while he was also an examiner for seven years to the University of London. The posts of Croonian lecturer to the Royal Society and Hunterian professor in the College of Surgeons were likewise filled by him.

There is no doubt that Huxley was fortunate to obtain at 28 a post, worth nearly a thousand a year, in London, and unburdened with any excessive duties. He had to give during winter (October to end of February) a course of lectures on five days of the week, and attend in his study at the Museum in Jermyn street, but had not the cares of a laboratory. He carried out his researches alone, and consequently was able to arrange the employment of his day in his own way. He wrote largely for the press upon such topics as belonged to his branch of science; lectured frequently in other places besides Jermyn street; and took an active and important part in various government commissions, to which his official position rendered it proper that he should be appointed. His lectures to workingmen, in 1860, on the 'Relation of Man to the Lower Animals,' gave rise to much discussion, and led him to treat the subject in his 'Evidence as to Man's Place in Nature' (1863). By this time the Darwinian theory had given rise to much excited controversy, and Huxley's thorough-going Darwinism brought many a bitter attack upon him. In 1862 he was appointed by government to assist in inquiring into the effects of the acts regarding trawling for herring; and his labors and advice had much influence in determining the course of fishery legislation and administration. In 1870 his name became more prominent than ever on the publication of his collection of papers entitled 'Lay Sermons, Essays and Reviews,' which met with fierce denunciation in many quarters. In this year he presided over the Liverpool meeting of the British Association, and was also elected a member of the first London school board. In 1872 he was elected lord rector of Aberdeen University; in 1875–76 lectured on natural history in Edinburgh University.

In 1883 Huxley received the crowning honor of his life, being elected president of the Royal Society. But ill health soon compelled him to give up his official work. In 1885 he retired from his professorship, from his fishery post and from the presidency of the Royal Society, and confined himself to such work as he could perform in his study at Eastbourne (where in 1890 he built himself a house), or in the Engadine, where he usually spent the summer.

He produced between 1885 and his death in 1895 a large series of brilliant and interesting essays, especially on the relation of science to Hebrew and Christian tradition, and on the evolution of theology and of ethics. During this period he was president of the Marine Biological Association, in the founding of which he took an active part, and in 1892 was made a member of the Privy Council.

In 1888 Huxley received the Copley medal of the Royal Society, and in 1894 the Darwin medal. Huxley was one of the first scientists of his time; his chief and most valuable work was in the direction of the popularization of science, particularly of the Darwinian theory. He was also active along lines of social and political reform, and in the development and organization of scientific education. He wrote, besides the books already mentioned, 'Elementary Physiology' (1866); 'Anatomy of Vertebrated Animals' (1871); 'Critiques and Addresses' (1873); 'Elementary Biology' (with Dr. H. N. Martin, 1875); 'American Addresses' (delivered at New York in 1876 on the fossil horses, 1877); 'Physiography' (1877); 'Hume' (1878); 'The Crayfish: An Introduction to the Study of Zoology' (1880); 'Collected Essays' (1893–94). Between 1898 and 1902 there appeared four volumes of his 'Scientific Memoirs,' under the editorship of Sir Michael Foster and Prof. E. Ray Lankester. An authorized edition of his lesser works was published at New York between 1897 and 1900 in eight volumes. Consult Cadman, S. P., 'Charles Darwin and Other English Thinkers' (Boston 1911); Clodd, Edward, 'Thomas Henry Huxley' (New York 1902); Davis, J. R. A., 'Thomas H. Huxley'



THOMAS HENRY HUXLEY

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(ib. 1907); Fiske, John, 'Reminiscences of Huxley' (in 'Essays, Historical and Literary,' Vol. II, ib. 1907); Huxley, Leonard, 'Life and Letters of Thomas Henry Huxley' (London 1900); Mitchell, P. C., 'Thomas Henry Huxley: A Sketch of his Life and Works' (ib. 1900); Osborn, H. F., 'Huxley and Education' (New York 1910).

HUY, ü'ē', Belgium, a town on the right bank of the Meuse, at its confluence with the Hoyoux. It is in the province of Liège and 18 miles from the city of Liège. Interesting features are the old citadel, built in the rock wall, dating from 1822, topped by the ancient cathedral of Notre Dame with a 13th-century gateway. Huy had many educational institutions, including a theological seminary and teachers' institute. The ruins of the abbey of Nemoustier founded by Peter the Hermit on his return from the first Crusade are to be found in the suburbs. The principal occupation of the vicinity is the cultivation of grapes, and the distilling of wine. There is some manufacture of paper and cloth, and some tin mining. Because of its strategical position, Huy has been a battle ground and has changed hands many times. In 1703, it was captured by Marlborough and Coehoorn; and during the European War fell into the hands of the Germans in 1914, after a stubborn resistance. See War, European.

HUYGENS, hoi-gĕns or hī'gĕnz, **Christian**, Dutch mathematician, astronomer and physicist: b. The Hague, 1629; d. there, 8 June 1695. He studied at Leyden, and at Breda, where he went through a course of civil law from 1646–48. He settled in Paris at the invitation of the minister, Solbert, was elected to the Academy and was given rooms at the Royal Library. He returned to Holland when the Edict of Nantes was revoked, and remained there till his death. Among his most important contributions to science are his investigations on gravitational acceleration and the oscillations of the pendulum, which he was the first to apply to clocks, and his 'System of Saturn,' in which he first proved that the ring completely surrounds the planet, discovered the fourth satellite, and determined the inclination of its plane to that of the ecliptic. He perfected the telescope and invented the micrometer. In 1690 he published important treatises on light and on weight. His 'Traité de la lumière' was an exposition of the undulation theory, but in consequence of the prevalence of the Newtonian theory was long neglected till later researches established its credit. Huygens discovered the polarization of light, which he could not explain because he thought the vibrations of light longitudinal rather than transverse. He also investigated the theory of probabilities. Huygens also wrote 'Theoremata de Quadratura Hyperbolis, Ellipsis, et Circuli, ex Dato Portionum Gravitatis Centro' (1651); 'De Circuli Magnitudine Inventa' (Leyden 1654); 'De Ratiocinatione in Ludo Aleæ' (1656); 'Horlogium Oscillatorium, sive de Motu Pendulorum' (1673). His works have been published in 10 volumes by the Koninglijke Akademie van den Wetenskapen (The Hague 1888–1905). Consult Bosscha, 'Christian Huygens' (tr. into German, Leipzig 1895); Harting, P., 'Christian Huygens in Zijn Leven en Werken Geschetzt' (Groningen 1868).

HUYGENS, Constantin, Dutch writer: b. The Hague, 1596; d. 1687. From his early youth he received special training in diplomacy. He was educated at the universities of Leyden, London and Oxford. In 1620 he was special diplomatic envoy to Venice and the following year to London. King James I conferred knighthood on him in 1622. In 1625 he was appointed private secretary to the Stadtholder and five years later became a member of the Privy Council. His works include 'Batava Tempe' (1623); 'Costelick Mal' (1624); 'Otia, Ledige uren' (1625); 'Daghwerck' (1637); 'Hofwijck.' In 1658 his poems appeared in a collected edition entitled 'Korenbloemen,' and the year following appeared the drama 'Tryntje Cornelis.' Consult the autobiographical 'Cluyswerck' (Amsterdam 1841) and 'De Vita Propria' (ib. 1817); Dumesnil, A. J., 'Histoire des plus célèbres amateurs étrangers' (Paris 1860); Jorissen, 'Constantijn Huygens' (Amsterdam 1871).

HUYGENS' PRINCIPLE. See Light.

HUYSUM, hoi'sum, **Jan Van**, Dutch painter: b. Amsterdam, 1682; d. there, 8 Feb. 1749. His father was Justus van Huysum, a landscape painter and decorator of no mean skill. From him he acquired the art of painting formal landscapes, imaginative, and fine in coloring, but lifeless and studied in composition. No motion stirred the trees of his scenes, nor did any animation brighten the faces of the figures of his paintings. Later he abandoned landscape painting for still life reproductions and proved himself a consummate master in the art. His backgrounds are generally light, against which he projects gay bouquets of flowers and fruits, often introducing butterflies, insects, birds' nests, etc. His work is characterized by a remarkable perfection of detail and coloring, rarely surpassed. Later critics have found fault with this heightened perfection and have deplored the absence of breadth of treatment and insight. The works of Huysum are best seen at the Louvre; the galleries of Berlin, Amsterdam, Petrograd, The Hague, Copenhagen, Vienna; and in private collections in England.

HWANG or **HOANG-HO**, hwăng'hō, or **YELLOW RIVER**, China, a large river which rises in the mountains of North Tibet, in the Koko-Nor territory, about lat. 34° 30′ N. and long. 97° 30′ E. It derives its name from the vast quantities of yellow mud continually carried down by its waters. After a winding course, north, east and south, of about 2,600 miles, it flows since 1853 into the Gulf of Pe-chi-li; prior to that year its outlet was in the Yellow Sea. It is a turbulent, turbid and impracticable stream, but little used for navigation, and subject to disastrous floods is known as "China's" sorrow. The misery which followed the flood of 1898 was the chief cause of the Boxer Rebellion. To prevent inundation and the former frequent changes in its bed and outlet, great expense is incurred maintaining artificial embankments.

HYACINTH. (1) A genus (*Hyacinthus*) of lilies with corolla-like, bell-shaped, six-cleft perianth, six stamens fixed in the tube of the perianth, and dry capsular fruit. The Oriental hyacinth (*H. orientalis*), one of the chief favorites of florists, is a native of Asia Minor, Syria and Persia. It is now naturalized in some parts of the south of Europe. It has broad linear leaves, and a scape with a raceme of many flowers pointing in all directions. The flowers in cultivation exhibit great variety of color, chiefly blue, purple and white. They are very beautiful and very fragrant. The fragrance is strongest about or after 11 o'clock at night. Among cultivated hyacinths are many with double flowers. The hyacinth has been cultivated from a remote period. It was introduced into Europe, probably by the Dutch, about the beginning of the 16th century. The grape-hyacinth is a somewhat different plant of the genus *Muscari*, of which *M. racemosum* is common in gardens. (2) See ZIRCON.

HYACINTHE, Père, pãr ē-ã-sãnt. See LOYSON, CHARLES.

HYACINTHUS, in Greek mythology, the youngest son of King Amyclas of Amyclæ, who was killed by Apollo. The story is told as follows: Apollo, attracted by the beauty of the young prince, fell in love with him. One day while he was teaching the lad to throw the discus, Boreas (or Zephyrus), who was jealous, lifted the discus so that it struck and killed Hyacinthus. His death was greatly mourned by Apollo, who admitted him with his sister Polybœa to the immortals. A flower called the hyacinth grew up out of the blood of the boy, and on its petals were inscribed the word «AI,» the sound of mourning. The incident was commemorated by the Spartans by the feast of Hyacinthia, which was one of the most strictly observed of Laconian celebrations. Amyclæ, the scene of the event, was held highly sacred, for here was the tomb of Hyacinthus, on which stood a shrine to Apollo. Allegorically, the myth is generally interpreted as the slaying of the Spring by Summer. Consult Frazer, J. G., ‹Adonis, Attis, Osiris› (in the ‹Golden Bough,› Pt. IV, Book II, Chap. 7, London 1906).

HYADES, hī'ạ-dēz, in Greek mythology, the daughters of Atlas and Æthra. They lived at Dodona, where they cared for Zeus and nursed the infant Bacchus. As a reward they were translated to the stars. Another tradition makes them sisters of the Pleiades. Their brother Hyas having been killed, they mourned so for him that Zeus changed them into stars. Their rising and setting ushered in the rainy season in April and November. The Romans translated the name into «Suculæ» (little pigs), deriving the word from ὗς, sow. The Hyades were associated with the fertilizing principle of rain and moisture.

HYÆNODON, hī-en'ō-dȯn, a genus of primitive carnivorous mammals (*creodonts*), fossil in the Upper Eocene and Lower Miocene rocks of Europe, Africa and the western United States, of which several species are known by well-preserved skeletons. The skull was relatively very large and long, with great canines and strong, hyena-like molars, but the brain-cavity was very small. The feet were fully five-toed, had powerful claws, and the animal, which must have somewhat resembled a small, cat-like bear, was partly plantigrade. Species of this family (*Hyænodontidæ*) were the last of the creodonts, surviving to the Middle Oligocene (Oreodon zone).

HYALITE. A variety of opal (hydrous silica) which occurs in clear globular or botryoidal forms resembling drops of melted glass. Used as a gem. Occurs in Arizona and Georgia and a large deposit of banded hyalite in Beaver County, Utah, is being utilized to some extent.

HYAMS, Henry Michael, American lawyer and politician: b. Charleston, S. C., 1805; d. New Orleans, 1875. In 1828 he went to New Orleans, studied law, and after 15 years of country practice in Alexandria, La., resumed his residence in New Orleans, where his investments in landed property made him wealthy. In politics he was originally an old line Whig, but on the outbreak of Know-Nothingism joined the Democratic party. In 1855 he was elected to the State senate; in 1859 he was chosen lieutenant-governor, the first member of the Jewish race to hold such an honor in the United States. He was devoted to the Southern cause, sent his sons to fight in the Confederate army and after the war found his large fortune vanished. Prepared to begin life anew, he resumed the practice of law until his death.

HYATT, Alpheus, American naturalist: b. Washington, D. C., 5 April 1838; d. Cambridge, Mass., 15 Jan. 1902. He was graduated from the Lawrence Scientific School at Harvard in 1862, then entered the army and served during the war in the 47th Massachusetts regiment, being promoted to the rank of captain. After leaving the army, he resumed his studies under the instruction of Agassiz, and later studied abroad. In 1867 he went to Salem, where he was one of the founders of the Peabody Academy of Sciences and one of the curators of the Essex Institute. In 1870 he was made custodian of the collections of the Boston Society of Natural History, becoming curator in 1881. He was also professor of biology and zoology from 1877 to 1902 at Boston University; was organizer and manager of the Teacher's School of Science (1870–1902); had charge of a summer laboratory of marine zoology founded by the Women's Educational Society at Annisquam, which was later moved to Woods Hole where its work was greatly expanded with Hyatt as president of the board of trustees; he was also for 18 years professor of zoology and palæontology at the Massachusetts Institute of Technology. In his later life he had charge of invertebrate fossils in the Museum of Comparative Zoology at Cambridge. He was a member of the American Academy of Arts and Sciences, of the American Philosophical Society, of the Geological Society of London, of the National Academy of Sciences and of the American Society of Naturalists. He was one of the founders of the last mentioned society and its first president (1883); he was also one of the founders and, from 1868–71, editor of the *American Naturalist*. He held the honorary degree of LL.D. from Brown University. His most distinctive work was the investigation of the development of the fossil *Cephalopods* and of the fossil and semi-fossil *Planorbis* on Steinheim Lake, Germany, from which investigations he deduced laws of growth very important to the evolutionary theory. He was also especially successful as a teacher of science teachers. His interests were broad and he was a member of that remarkable coterie of intellects which adorned Boston in the latter part of the 19th century, including Longfellow, Emerson, Holmes, James and others. His works include ‘Observations on Polyzoa’ (1866); ‘Fossil Cephalopods of the Museum of Comparative Zoology’ (1872); ‘Revision of North American Poriferæ’ (1875–77), the only work on North American commercial sponges; ‘Genesis of Tertiary Species of Planorbis at Steinheim’ (1880); ‘Genera of Fossil Cephalopoda’ (1883); ‘Larval Theory of the Origin of Cellular Tissue’ (1884); ‘Genesis of the Aretidæ’ (1889); ‘Carboniferous Cephalopods’ (1891–93); ‘Bioplastology and the Related Branches of Biologic Research’ (1893); ‘Phylogeny of an Acquired Characteristic’ (1894); ‘Pseudocerabites of the Cretaceous’ (1903); ‘The Triassic Cephalopod Genera of America’ (1905). All of these were published in scientific journals or as part of official scientific reports, as were also many other shorter papers on similar subjects. A full bibliography will be found attached to the memoir by W. K. Brooks, ‘Alpheus Hyatt’ (in *National Academy of Sciences, Biographical Memoirs,* Vol. VI, p. 311, Washington 1909). Consult also Anon., ‘Memorial of Professor A. Hyatt’ (in Boston Society of Natural History, Proceedings, Vol. XXX, p. 413, Boston 1902); Jackson, R. T., ‘A. Hyatt and his Principles of Research’ (in *American Naturalist,* Vol. XLVII, p. 195, Lancaster 1913); Mayer, A. G., ‘Alpheus Hyatt’ (in *Popular Science Monthly,* Vol. LXXVIII, p. 129, New York 1911); Packard, A. S., ‘Alpheus Hyatt’ (in American Academy of Arts and Sciences, Proceedings, Vol. XXXVIII, p. 715, Boston 1903); Zirngiebel, F., ‘Teachers' School of Science’ (in *Popular Science Monthly,* Vol. LV, p. 451, New York 1899).

HYATT, Anna Vaughn, American sculptor: b. Cambridge, Mass., 10 March 1876. After a preliminary education at private schools, she studied at the Art Students' League, New York, and later under Henry Kitson, H. A. McNeil and Gutzon Borglum. Her works consist mainly of small bronzes of animals, which are executed with rare spirit and delicacy. They have appeared at various exhibits and a number are owned by the Metropolitan Museum. Her larger pieces include a lion at Dayton, Ohio; a memorial statue at Lancaster, N. H.; ‘Joan of Arc,’ New York city. Miss Hyatt has been awarded honorable mention at the Paris Salon (1910); silver medal at the San Francisco Exposition (1915); Rodin gold medal at Philadelphia (1917), and was appointed curator of sculpture in the French Museum of Art in the United States.

HYBLA, hī-bla, the name of several ancient cities in Sicily, of which the best known are Hybla Major, identified with Hybla Megara, a seaport near Syracuse; and Hybla Minor, or Galeatis, near Mount Ætna, where the city of Paterno now stands. Hyblæan honey, celebrated in Roman poetry, is generally supposed to have come from the former city.

HYBRIDITY, the crossing of two individuals of distinct species. The result of the intercrossing of species is a hybrid, for example, the mule, which is the result of breeding the horse with the ass. As the mule is invariably sterile, the infertility has always been supposed to be a test of species. But this is not an invariable rule, as not a few so-called “good” species have been crossed with one another. It may be set down as a general proposition that the difficulty of crossing increases the more distant the systematic relationship of the species experimented with. Also these difficulties are, says Hertwig, by no means directly proportional to the systematic divergence of the species.

Nature tends to keep species separate, in the higher animals, as well as among insects, etc.; mating is usually prevented by the structure of the parts concerned with sexual union; also the principle of preferential mating comes into play among mammals as well as insects, as often between males and females, even of closely allied species or varieties. When there are no structural differences there may exist an aversion which prevents any union of the sexes.

Artificial Hybridization.— Many experiments have recently been made on the lower marine animals in which the eggs are fertilized in the sea without sexual union, by placing the eggs of starfish and sea-urchins, etc., in a watch-glass and adding the sperm of the males, thus securing artificial fertilization. In this way hybrids have been obtained from species belonging to quite different genera, while it has been found that in some cases closely related species will not cross. For example, among the sea-urchins the spermatozoa of *Strongylocentrotus lividus* readily fertilize the eggs of a species of Echinus, but only rarely those of the more closely allied *Sphærechinus granularis.* Hybrids have been obtained from different genera of fishes, as those between the salmon and brown trout. It appears that salmon eggs have been fertilized by trout sperm, but not trout eggs by salmon sperm. According to Hertwig eggs have been fertilized by sperm belonging to species of different families, orders and possibly classes. For example, the eggs of a flounder (*Pleuronectes platessa*) and of *Labrus rupestris* have been fertilized by the sperm of the cod; frog's eggs (*Rana arvalis*) by sperm of a triton, and even, it is said, the eggs of a starfish by milt from a sea-urchin; in such cases, however, the hybrids die during or at the close of segmentation of the yolk.

Fertility of Hybrids.— While the mule and many other hybrids are sterile, there are some known exceptions. Hybrids of hares and rabbits have continued fruitful for generations, and also hybrids obtained from the wild buck and she-goat, from the Chinese goose (*Anser cygnoides*) and the common goose (*A. domesticus*); from *Salmo salvelinus* and *S. fontinalis; Cyprinus carpio* and *Crassius vulgaris,* as well as between the two silkworm moths, *Philosamia cynthia* and *P. ricini,* the Arrhindy worm. In this country Caton has hybridized the common Virginian deer with the Ceylon deer and the Acapulco deer, and states that the hybrids seemed perfectly healthy and prolific. Ewart states that the Indian buffalo and the American bison produce fertile hybrids with the European wild ox.

In the human species it is a well-established fact that marriages between remote varieties or races tend to sterility, while crossing between allied races are fertile, and such unions are most beneficial. Thus the most mixed white races are the most fertile and vigorous. Ewart thinks that as there are no definite limits between species and varieties, there can be «no fundamental difference between a hybrid and a cross, nor yet any *a priori* reason why any given hybrid should be sterile, or any given cross fertile.» He also states that sterility has in some cases been slowly acquired, in others abruptly, but how it has been acquired is not known.

As the result of breeding thousands of moths Standfuss states that in no case observed by him has the female of a true hybrid been shown to be fertile. On the other hand, the occurrence of undoubted cases of fertility in male hybrids has been proved by crossing the male hybrids with the females of both parent species.

Ewart's Experiments with Crossing the Zebra and Horse, and the Wild Ass and Horse.— A Burchell's zebra stallion, «Matopo,» became the father of nine zebra hybrids by mares of various sizes and breeds. The hybrids exhibited a curious blending of characters, which seemed to have been derived partly from their actual and partly from their remote ancestors; some of the hybrids strongly suggest their zebra sire, others their respective dams, «but even the most zebra-like in form are utterly unlike their sire in their markings.»

He succeeded in securing a male wild ass (kiang) from central Asia and a couple of Mongolian pony mares, one a yellow dun and the other a chestnut. The wild ass was mated with the dun Mongol mare, a brownish-yellow Exmoor pony and a bay Shetland-Welsh pony. The kiang hybrid in its long legs, slender joints and speed took after its kiang parent. The mane and tail «are exactly what one would expect in a mule.» This kiang hybrid also differs from the wild horse (Przewalsky's horse) in not neighing like a horse. The result is to prove that the wild horse is not a kiang-pony male, but a «good» species. Also in accordance with Mendel's law (see under HEREDITY) the kiang proved to be dominant, the Exmoor pony recessive. It is generally held that an old species is prepotent over a more recent variety.

Hybridity in Plants.— The method of hybridizing hermaphroditic flowers is to cut away their stamens before they are ripe and then enclose the flower in a paper bag. After the stigma has ripened the pollen is placed on it, the bag is again tied over the flower and not removed until the seed begins to form. Great advantages and improvements in agriculture have resulted from hybridizing plants, chief among which are many new varieties of cultivated plants, increased size and vigor, hardiness, or adaptation to warmer climates, and increased resistance to disease, as well as increase in odor of flowers and the quality and flavor of fruits.

Sterility in Hybrids.— Thus far the cause of infertility in animals is unknown, but botanists attribute the frequent sterility of plants to the imperfect formation of the pollen. Standfuss' experiments with moths agree with Focke's statement as to the great variability of the offspring resulting from the crossing of a plant hybrid with one of the parent species. In plants, as discovered by Mendel, the proportion of the pure races is constantly increasing in the successive generations descended from a hybrid. Malformations and sports are much more frequent, especially in the floral organs in hybrids, than in individuals of a pure descent. Double flowers appear to be formed especially easily in hybrids. Recent experiments and results in the study of hybridity show how intimately the subject bears on heredity (q.v.) and the origin of species.

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HYBRIDS IN PLANTS. A hybrid may be defined as a cross between two parents belonging to different varieties or different species. In a few cases, two different genera have been crossed. Thus, it is evident that the term, hybrid, is used whenever the two parents do not belong to the same species or variety. Consequently, a hybrid differs from the result of ordinary fertilization only in the fact that the two parents are not so closely related. When hybrids are produced artificially, the pollen from one parent is placed upon the stigma of the other parent, great care being taken to exclude all other pollen. When the parents are diœcious — the male bearing only anthers with pollen, and the female only ovaries tipped with stigmas — it is easy to exclude other pollen by placing a paper bag over the female flowers. When the anthers and ovaries are on the same plant, but in different flowers — as in corn, where the tassel bears the anthers and the silk is tipped with the stigmas — there is little difficulty in making a cross. The tassel of the plant to be used as the female parent is cut off before it ripens any pollen; a tassel from the male parent is shaken over the silks of the female until the silks are well dusted with pollen; a paper bag is then placed over the silks. It is an interesting fact that in corn, the male parent determines whether the content of the grain is to become starch or sugar, i.e., whether there is to be «sweet corn» or «field corn»; so that sweet corn may be raised on a plant grown from field corn seed, and vice-versa. When the two parents, anthers (male) and ovaries (female), are in the same flower, as in lilies and most flowers, the anthers of the flower to be used as the female parent must be removed before they ripen their pollen, lest "close fertilization" might result. The stigma is then dusted with pollen from the male parent, and a paper bag is applied. While numerous hybrids occur in nature, artificial hybridization is of immense importance, economically, in developing new forms better suited to local conditions, since desirable features of different "races," "strains" or varieties, as various degrees of close relationship are denominated, may be combined by judicious crossing.

The term, graft hybrid, has become fixed in the literature of the subject. As the name implies, it is a hybrid secured by grafting. Such hybrids have been known for nearly 100 years; but they have more recently come into prominence through the researches of Winkler, who succeeded in grafting the nightshade (*Solanum nigrum*) upon the tomato (*Solanum lycopersicum*). The resulting form had some leaves like those of the nightshade and some like those of the tomato and still others showed mixed characters; altogether, the "hybrid" was so bizarre that it was called a *chimera*. It is now believed that such chimeras are not the result of any blending of characters but that they are built up of pure cells of the two "parents," so that the *chimera* may be regarded as a mosaic built up of two kinds of blocks, the cells representing the blocks. Consult Winkler, H., ‘Untersuchungen uber Propfbastarde’ (Jena 1912). A review, with references, may be found in the *Botanical Gazette* (Vol. LI, 1911, p. 147).

Charles J. Chamberlain.

HYDASPES. See Jhelam.

HYDATHODES, hī'dă'thōdz, special surface organs or glands on plant leaves exuding water when there is excess pressure in the moisture channels, due to diminished transpiration. They are of great variety and widely distributed, especially in the tropics where the roots of plants absorb abundantly under humid atmospherical conditions. Some hydathodes both secrete and excrete moisture.

HYDATID, hī'dā-tĭd. See Bladderworm; Tapeworm.

HYDE, Anne, Duchess of York, eldest daughter of the Duke of Clarendon, and first wife of James II of England: b. 1637; d. 1671. At the age of 17 she became maid of honor to the Princess of Orange, and while visiting in Paris in the retinue of the Princess made the acquaintance of James who was then Duke of York. Despite the disapproval of both families, the young couple were married in September 1660. Slander and threats were used to dissolve the match, but Anne maintained a dignified aloofness to all interference. In 1667 she became a Roman Catholic, converting her husband shortly after. She was the mother of queens Mary and Anne.

HYDE, Douglas, Irish author and historian: b. Frenchpark, County Roscommon, 1860. After receiving his bachelor's degree from Trinity College, Dublin, in 1884 and his LL.D. three years later, he became interim professor of modern languages at the State University of New Brunswick (1891). Hyde's chief title to fame rests on his splendid studies of Irish literature and his collections of Irish folklore. He is a prominent figure in the Irish national revival. He was president of the Irish National Literary Society (1894–95), and was one of the prime organizers and first president of the Gaelic League, resigning from that office in 1915. In Ireland he is popularly known by the Gaelic pseudonym of "An Craoibhin Aoibhinn" (sweet little branch). In 1906 he visited the United States in order to raise funds for the support of the league, and was successful in collecting some $55,000. He was president of the Irish Texts Society; examiner in Celtic to the Royal University of Ireland; assistant editor of the New Irish Library; a member of the Royal Commission on Irish University Education; and a member of the senate and professor of modern Irish in the National University of Ireland (1909). Hyde's most monumental work is his ‘Literary History of Ireland’ (1899), a fine piece of pioneer scholarship. His other writings are in varied literary forms: lyrics, essays, folktales, plays and history. He writes with equal fluency and skill both in Gaelic and English. His numerous works include ‘Leabhar Sgeuluigheachta’ (1899); ‘Beside the Fire’ (1890); ‘Cois na teincadh’ (1891); ‘Love Songs of Connacht’ (1894); ‘Three Sorrows of Story Telling’ (1895); ‘Story of Early Irish Literature’ (1897); ‘An Sgeuluidhe Gaodhalach’ (1898–1901; translated into French, 1901); ‘Mediæval Tales from the Irish’ (Vol. I of Irish Texts Society, 1899); ‘Ubhla den Chraoibh’ (Irish poems, 1900); ‘Casadh an tsugáin’ (a play in Irish, 1901); ‘Sgéalta’ (1902); ‘Filidheacht Ghaedhalach’ (1903); ‘Raftery's Poems’ (1904); ‘The Bursting of the Bubble,’ ‘An Pósadh,’ ‘An Cleamhnas,’ ‘King James,’ ‘The Tinker and the Fairy’ (Irish plays, 1905); ‘The Religious Songs of Connacht’ (1906); ‘Sgéaluidhe Fíor na Seachtmhaine’ (1909); ‘Maistin an Bheurla’ (a play, 1913); ‘Legends of Saints and Sinners from the Irish’ (1915). Many of his poems reproduce the exact metre of the original Gaelic verse, and are replete with quaint conceits which show a sympathetic and scholarly handling of the translations. Dr. Hyde has kept aloof from the political and religious embroilments which have torn the Irish nationalists, preferring always to keep the main problem above party interest.

HYDE, Edward. See Clarendon, Edward Hyde, Earl of.

HYDE, Edward. See Cornbury, Edward Hyde, Lord.

HYDE, Edward, British colonial governor in America: b. England, about 1650; d. North Carolina, 8 Aug. 1712. In 1710 he arrived as governor of the Albemarle district of North Carolina province. The provincial governor, by whom he was to be commissioned, was dead, and Thomas Carey, formerly a deputy governor, had undertaken an armed insurrection. Hyde, at the request of the better class of the population, took office as governor and, assisted by Spottswood, governor of Virginia, crushed the revolt. Not long after massacres by the North Carolina Indians compelled him to seek aid from Virginia and South Carolina.

HYDE, Helen, American artist: b. Lima, N. Y. After a preliminary course at the Wellesley School, Philadelphia, she studied under Emil Carlsen at the San Francisco Art Institute. Later she continued her work under Frank Skarbina, Berlin; Raphael Collin, Paris, and Kano Tomonobu, Tokio. Miss Hyde's best work is in studies of women and children, executed chiefly by wood cut and etching. Particularly charming are her wood cuts and water colors of Japanese women and children, the fruit of 14 years of work in Japan. On her return to the United States, she made a series of cuts of Mexican subjects, which are preserved in the Congressional Library at Washington. Others are to be seen at the New York Public Library and the Art Museum at San Francisco. Miss Hyde is a member of various American, European and Asiatic art and etching societies.

HYDE, William Dewitt, American college president: b. Winchendon, Mass., 23 Sept. 1858; d. 29 June 1917. He was graduated from Phillips Exeter Academy in 1875, from Harvard in 1879, and studied theology at Union and Andover. After completing his theological studies he was pastor for a time at Paterson, N. J. In 1885 he became president of Bowdoin College; at that time he was the youngest college president in the United States, and was not widely known. He soon gained a high reputation as a scholar and an able executive, the college growing largely in numbers and resources during his administration. His clear, logical and brilliant contributions to American literature include ‘Practical Ethics’ (1892); ‘Social Theology’ (1895); ‘Practical Idealism’ (1897); ‘The Evolution of a College Student’ (1898); ‘God's Education of Man’ (1899); ‘The Art of Optimism’ (1900); ‘Jesus' Way’ (1902); ‘The College Man and the College Woman’ (1906); ‘Self Measurement’ (1908); ‘Sin and its Forgiveness’ (1909); ‘The Five Great Philosophies of Life’ (1911); ‘The Gospel of Good Will’ (1915).

HYDE, England, a town and municipal borough in Cheshire, on the Tame River, about eight miles east of Manchester on the Great Central Railway. The principal industry is cotton manufacture. There are also important iron works, and factories for machinery, hats and margarine. Coal-mining is extensively carried on in the district. Its greatest increase of population has taken place within the last century, due to the increase in the number of factories and the development of the collieries. The old manor hall once owned by the ancient family of Hyde dates from the reign of King John. Hyde received its charter as a municipal borough in 1881, and is governed by a mayor, six aldermen and 18 councillors. The municipality owns its waterworks, sewage plant, markets and cemetery. There are also a library, public baths and a hospital. Area, 3,081 acres. Pop. 33,500.

HYDE PARK, London, a park in the West End, adjoining Kensington Gardens. It derived its name from having been the manor of the Hyde belonging to the abbey of Westminster, and contains nearly 400 acres. It was opened to the public shortly after the Restoration in 1660, and abounds with fine trees and pleasing scenery. The sheet of water called the Serpentine River was made between 1730 and 1733 by order of Queen Caroline. It is much frequented in summer for bathing, and during frosts for skating. The park is the regular meeting place for public speech on popular questions by independent orators. Attractive features of the park are the fashionable drive, bridle path, promenade of Rotten Row, the Ladies' Mile, Marble Arch and the statue of Achilles by Westmacott, cast from the cannon trophies of Waterloo, in honor of the Duke of Wellington.

HYDE PARK, Mass., a former town in Norfolk County, on the Neponset River, and on the New York, New Haven and Hartford Railroad, southwest of, but since 1912 incorporated with, Boston. The town enclosed four villages and was incorporated in 1868. Rubber goods, paper, morocco, cotton and woolen goods, curled hair, chemicals, dyestuffs, looms and machinery are manufactured within its boundaries. It is a residential suburb for many Boston business men. It has good schools and a well-equipped free library. Pop. 15,507.

HYDE PARK, Vt., village in the town of Hyde Park, county-seat of Lamoille County, on the Lamoille River and on the Boston and Maine Railroad, about 31 miles northeast of Burlington and 23 miles north of Montpelier. Stone quarries nearby are worked and flour, lumber, dairy products and leather are manufactured. Pop. about 500.

HYDER ALI, hī'dėr ä'lē, Indian Mohammedan prince: b. Bangalore, about 1728; d. Chittore, 7 Dec. 1782. Of humble origin and unable to read or write, his bravery at a siege in 1749 attracted the notice of the Rajah of Mysore; deposing Kandih Rao, he was chosen Rajah of Mysore in 1762, and he so greatly extended his dominions, that in 1766 they contained 84,000 square miles, and afforded an immense revenue. His reign was passed in wars with the English and with the Mahrattas. A treaty which he made with the East India Company in 1769 for the mutual retrocession of all conquests, was violated in 1780, and, forming an alliance with the Mahrattas, he obtained the services of French officers, invaded the Carnatic and took Arcot on 31 October of the same year. He was finally defeated by Sir Eyre Coote, 1 June 1781. He was succeeded by his son Tippoo Saib (q.v.). Consult Bowring, ‘Haidar Ali’ (in the ‘Rulers of India’ series, 1893).

HYDERABAD, hī-dėr-ạ-bäd', or **HAIDARABAD,** hī-dạ-rạ-bäd', India. (1) One of the largest native states occupying the greater part of the Deccan plateau of southern India, in possession of the Nizam, a Mohammedan prince, and frequently called the Nizam's Dominions. It is bounded north by Berar, northeast by the Central Provinces, southeast by Madras and west by Bombay. Area, 82,698 square miles; pop. about 13,374,676. The chief rivers are the Godavari in the north and the Kistnah in the south. The soil generally is fertile but poorly cultivated; the principal crops are rice, wheat, maize, sugar-cane, tobacco, cotton and fruits. Indigo is manufactured, and the forests yield valuable timber; there are coal and iron deposits, and diamonds and other gems are found. The ruler belongs to the dynasty founded by Asaf Jah, a distinguished soldier, whom the Emperor Aurungzebe made viceroy of the Deccan in 1713 with the title of Nizam or Regulator.

(2) Hyderabad, the capital, is on the Musi River, at an elevation of 1,672 feet above the sea, about 400 miles in a direct line southeast of Bombay, with which it is connected by rail. It is wall-girt, and its chief buildings are the extensive nondescript palace of the Nizam, the handsome British Residency, the Charshinar, or Four Minarets, built about 1590 as a Mohammedan college, but now used for warehouses, and the Jumma Musjid or cathedral mosque, a reproduction of that at Mecca. Pop. about 500,623. (3) Hyderabad, the capital of a district of Sindh, British India, on the east bank of the Indus, is a well-fortified town connected by rail with Karachi, 105 miles to the southwest. Pop. 76,000.

HYDRA, hī'dra, a monster well known in Greek fable. She was the offspring of Echidna and Typhon, and inhabited the marshes of Lerna, not far from Argos. She had many heads, which were endowed with the faculty of renewing themselves endlessly. Thus, although many heroes tried to slay the hydra, Hercules alone succeeded by a clever trick. As fast as he severed her heads, Iolaus, his companion, burned the roots with a flaming brand. The central head which was immortal was buried underneath a huge rock by the hero who then dipped his arrows in the poisonous blood of the hydra. With these weapons he slew the gorgon, Medusa. According to Preller, the hydra-myth is the allegorical interpretation of the damp ground of Lerna, with its numerous springs which exuded a poisonous vapor. The slaying of the hydra by Hercules signifies the purification and draining of the marsh.

HYDRA, a minute fresh-water polyp, living on the stems and underside of submerged leaves. The body is a club or vase-shaped sac, the mouth at the upper end surrounded by a crown of from five to eight long tentacles armed with lasso or nettling cells buried in the skin. The hydra feeds on minute crustacea, etc., which become paralyzed when swimming in contact with the arms of the hydra, thus being easily drawn by the creature into its stomach. The body is very retractile, and the hydra can slowly move from one place to another, by detaching the end of the body. The sexual cells are, during the reproduction season, developed in the skin, appearing as circular swellings, one (male) just below the tentacles, the other mass, corresponding to the ovary of higher animals, farther down the body. The hydra is famous from its power of regenerating parts of its body. Trembly in 1744 experimented upon this animal; he cut them in two, also into slices, and found that each bit became a new hydra, finally he turned one inside out, the stomach-lining becoming the skin, this experiment having recently been successfully repeated. This is due to the lack of differentiation in the tissues and organs of the body, there being no distinct nervous, or circulatory system, the hydra being the most generalized member of its class, except the Protohydra, which has no tentacles. See Hydrozoa.

HYDRA, Greece, an island five miles off the east coast of Morea. Its length is 11 miles, and its breadth three miles, at its widest point. The island is rocky, with steep cliffs descending to the sea. Hydra, the main town, was in former times an important seaport, but has greatly declined. Silk, cotton, leather goods and ships are manufactured, and there is still some trade. Hydra is the seat of a bishopric. Pop. about 6,000.

HYDRANGEA, hī-drăn'jē-ą, a genus of shrubby plants of the family *Hydrangeaceæ,* with about 35 species indigenous to eastern Asia and temperate America. They have large simple leaves and very large cymes of flowers, the outer ones often infertile. *H. arborescens* grows on the Alleghanies, and in other parts of the United States. *H. radiata,* a more ornamental shrub, occurs in the region of the southern Alleghanies. *H. quercifolia,* distinguished by its lobate leaves, inhabits the States bordering the Gulf of Mexico. The best-known species is *H. opuloides,* a common greenhouse plant. *H. paniculata,* a hardy species, is one of the commonest cultivated shrubs. Both the last are natives of China and Japan.

HYDRANTS. See Valves and Hydrants.

HYDRASTIS, a genus of plants of the *Ranunculaceæ* family, having two species, *H. canadensis,* popularly known as orangeroot, yellowroot and golden seal, and a Japanese variety of which little is known. The rhizome and rootlets are used as a bitter stomachic tonic and a tonic to the uterus in various diseases. In poisonous doses it stops the heart-action.

HYDRATE, in chemistry, a compound containing one or more molecules of the radical «hydroxyl» (OH). In these compounds, the water may be considered as playing the part of an acid, and the compounds themselves are entirely analogous to salts. Thus water, H_2O, combines with sodium oxide, Na_2O, according to the equation $Na_2O + H_2O = 2\ NaOH$; the reaction being accompanied by the liberation of considerable heat. The sodium hydrate (NaOH) that is produced is quite a different substance from the simple oxide, Na_2O, and it cannot be resolved into Na_2O and water by the action of heat alone. In organic chemistry hydrates are met with very frequently. The large and exceedingly important class of substances collectively known as the alcohols, for example, are hydrates of organic radicals. See Alcohol.

The word «hydrate» is also used in a less definite manner, to signify any compound which contains water, or from which water can be expelled by the action of heat. Thus salts or minerals which are associated with water of crystallization are said to be «hydrated.» When an aqueous solution of a salt, containing an excess of the salt in the free state, is cooled until it freezes, a mechanical mixture of ice and of the precipitated salt is obtained, which is known as a «cryohydrate,» although it is not a definite chemical compound.

HYDRAULIC (hī-drâ'lĭc) **CEMENT.** See Cement.

HYDRAULIC CRANE, a type of crane in which the motive power is water under hydraulic pressure. There are two general styles of hydraulic cranes: direct-acting and indirect-acting. In the former class the lifting mechanism is applied directly to the load; in the latter the power works upon a system of pulleys and chains, for the purpose of increasing the speed of operation, or of multiplying the working force. The mechanical action of the hydraulic crane is the same as in the hydraulic press (q.v.).

The direct-acting cranes are of two distinct designs; those in which the lifting mechanism is contained within the post of the crane, and those where the lifting cylinder with its piston and ram is suspended from the crane-head, as in the Armstrong crane. The indirect mechanisms are generally placed horizontally in a pit under the base of the crane, the operating chains passing up through the post and thus to the crane-head. Provision is generally made also for revolving the crane by the hydraulic power.

The hydraulic crane has a decided mechanical advantage in conditions where a very great force is to be exerted through a comparatively short lift. In the Armstrong crane, however, lifts of 40 feets are attained with remarkable speed. It is economical as compared with other forms of cranes, because when the crane is idle no power is being used to keep up the momentum of the driving machinery, as with steam and electric cranes. Moreover, the hydraulic crane has but very few moving parts, and there is therefore a minimum of wear and great durability. It is, besides, capable of instantaneous control, impossible in any form of geared cranes. In the direct-acting hydraulic cranes the efficiency is close to 90 per cent.

In designing a hydraulic crane the formula commonly in use is that for each pound of pressure per square inch on the lifting piston a "head" of 2.31 feet is required in the water-supply — whence the required head of water will be the total lifting power desired divided by the area in square inches of the lifting piston, multiplied by 2.31. As a matter of practice the pressure of the water used is not often due directly to a head of falling water, but to water from hydraulic accumulators which is under the pressure of weights and sustained by high-pressure pumps. The water pressures commonly in use vary from 400 pounds to 1,200 or even 1,500 pounds per square inch, that most frequently found being about 700 pounds. There are, however, a number of cranes known as low-pressure cranes in which the working pressure is 70 pounds per square inch, or even lower. These cranes are usually run by direct gravity water pressure from an elevated tank in a nearby tower, supplying a water main with hydrants, the crane itself being movable and arranged to be coupled to the nearest hydrant.

Hydraulic cranes, especially if of the low-pressure type, are susceptible to damage by frost, and in order to reduce the freezing point of the water with which they are operated to a temperature at least as low as the weather conditions may produce, various substances have been added to the water. Glycerine has had the preference, but its cost has been almost prohibitive. Alcohol has been used, but the most economical substances have been cheap, non-corrosive salts. The cylinders, pipes and valves are covered with non-conducting coatings, and the exhaust of the compressor-pumps has been utilized to impart some warmth to the water. In high-pressure cranes the danger of freezing is very much less. Consult Boettcher, A., 'Cranes' (London 1908); Collyer, F., 'Hydraulic, Steam and Hand Power Lifting and Pressing Machinery' (London 1892).

HYDRAULIC ELEVATORS. See ELEVATORS.

HYDRAULIC ENGINE, an engine which is driven by the power or pressure of water seeking a lower level. The simplest form of engine utilizing water power is the water-wheel. The overshot wheel acts partly by the impact of the stream flowing in the sluice, partly by the weight of the water in the buckets; the breast wheel gets its power almost wholly from the rush of the water, but to a small degree by the weight of water in the curved buckets; the undershot wheel is acted upon purely by the force of the moving stream, and thus is the more purely hydraulic of the three. (See WATERWHEELS). The turbine wheels are highly developed hydraulic engines. They utilize the power of falling water in one of three ways: as axial turbines, in which the water is supplied and discharged in a current parallel to the axis; as outward flow turbines, in which the water enters and is discharged in currents radiating away from the axis; as inward flow turbines, in which the water enters and is discharged in currents converging radically toward the axis. (See TURBINES). The well-known hydraulic ram (q.v.) is another simple form of hydraulic engine, but is wasteful of power even in the most improved forms.

The rotary forms of hydraulic engines such as the turbines, Pelton wheels, etc., have proved difficult of adaptation to many forms of work on account of the high speed at which they run, and the necessity of gearing them down to the usable speed, which renders them less flexible. But a more potent objection is that they vary extremely in efficiency under varying speeds. These difficulties led to the invention of the reciprocating hydraulic engine, which has been found dependable and very steady in operation, although it must run always at the same speed, using the same power, no matter what its load: it is therefore of commendable efficiency (about 65 per cent) only when running under a full load. The reciprocating engine which has found most favor is the Brotherhood hydraulic engine, or modifications of it. This engine has three cylinders set at angles of 120 degrees with each other, the three piston rods working on the same crankpin. Each cylinder has a single port which becomes alternately an inlet and an outlet, the cylinders being all the time full of water, that on one side of the piston having a greater pressure than that on the other. The opening and closing of the ports and of the inlet and outlet valves is accomplished by a rotary valve mechanism carried by the crank shaft. The piston speed of these engines is about 30 feet per minute for all sizes, and they are built up to 30 horse power. They are built for use with water pressures (in pipes) ranging from 60 pounds per square inch up to 1,000 pounds per square inch. Another type of reciprocating engine is the Riggs hydraulic engine. In this, the crankpin is fixed, and the cylinders, fastened 120 degrees apart upon a disc, revolve with the disc around. Consult Butler, E., 'Modern Pumping and Hydraulic Machinery' (London 1913); Dunkerley, S., 'Hydraulics' (Vol. 1, "Hydraulic Machinery," London 1907); Gelpke, V., and Van Cleve, A. H., 'Hydraulic Turbines' (New York 1911); Gibson, A. H., 'Hydraulics and Its Applications' (New York 1915).

HYDRAULIC ENGINEERING, that branch of civil engineering which deals with the application to the use and convenience of man of the natural laws governing water and other liquids. In practice it is closely connected with and utilizes the details of other branches, such as mechanical, electrical, mining and the almost infinite subdivisions of engineering. During recent years the range of uses of water has rapidly expanded and the hydraulic engineer is being called upon to solve more and more intricate problems growing out of the increasing density of population and multiplication of industries. In the practice of his profession, especially in relation to the larger problems, he must have available the results of meteorological observations,— of the occurrence of water in the form of rain or snow,— and obtain data as to variations in precipitation which takes place from day to day and from year to year and of the resulting stream flow. He must consider the topography of the country and the possibility of building storage reservoirs to conserve the supply; he must be prepared to discuss the questions of river control, of erosion and sedimentation; and of the use of water in domestic and municipal supplies, also in the production of power in manufacturing and for other purposes created by the ever-growing needs of a civilized community. In earlier years when the sparse population was occupied mainly in agricultural pursuits and the industries were few, there was usually enough water and to spare, especially in the humid areas of Europe and America. No great difficulty was found in procuring ample drinking water and there was little interference of one community with another through pollution by discharging sewage or manufacturing wastes into the streams. With the rapid change from a rural to an urban population and with the growth of manufacturing centres, the question of obtaining adequate supplies has become more pressing; joined with this have been conflicts between the diverse interests of manufacturing, power production and navigation.

Operations.— The operations of hydraulic engineering may be classified according to the uses to which the water is put. First is that for drinking, for domestic and municipal supply. Mankind under ordinary conditions can exist only a few days without water and to retain good health the water must be of a high degree of purity. It is obvious therefore that the procuring of water for immediate consumption, for cooking and related purposes, must take precedence. Second in importance is the use of water in the production of food, including in this the watering of live stock and the artificial application of water to agricultural soils or irrigation in arid or drought-stricken regions. Correlated with irrigation is drainage or the removing of an excess of water from farm lands. The third class of uses of water is that of disposing of the sewage or the waste from centres of population and manufacturing establishments. Wherever adequate supplies of water have been provided for municipal purposes there arises at once the need of disposing of an equal quantity of sewage or industrial effluents. The importance of this has not always been recognized and the public health has been needlessly sacrificed because of neglect of this important detail of hydraulic engineering. A fourth use and one in which the hydraulic engineer has made the most rapid progress during the past quarter of a century has been in connection with water-power development and employment of water in manufacturing, including the production of steam. For years following the development of the steam engine the water powers of the country gradually fell into disuse; but with the improvement of methods of generating and transmitting electricity the hydraulic engineer is called upon to co-operate with the electrician in developing hydro-electric power, often at remote points. At the same time the necessity of procuring an ample supply of pure water for certain manufacturing purposes as well as for the steam engine has become more pressing and requires that the hydraulic engineer cooperate with the chemist in obtaining the desired quality as well as quantity. In the fifth group of uses are the details of transportation by water or navigation. The rapid development of the steam locomotive put out of use the canal boat and caused the abandonment of inland waterways in very much the same way as the stationary steam engine overshadowed the water powers. Similarly there is now a revival of interest in navigation of inland waters. The hydraulic engineer is again called upon to take up questions of improvement of rivers, particularly of the deepening and maintenance of channels. Closely joined with these are the problems of flood protection or prevention. With the increase of industries upon the flood plains of the rivers, thc annual losses have been becoming greater and greater and reach into millions or tens of millions of dollars. For instance in the State of Kansas the flood losses for a little over a decade have been estimated at over $50,000,000 and at Pittsburgh, Pa., for 10 years they have amounted to over $12,000,000.

Wide Range.— Hydraulic engineering in its practical application thus calls into play almost the entire range of civil engineering activities and requires co-operation at one time or another with the chemist, physicist, electrician, topographer, geologist, meteorologist and with other students of natural phenomena. Its distinguishing feature is that fundamentally it deals with water in its various phases and has for its special province the practical application of the three distinct sets of laws or principles, namely, (a) hydrostatics, which relates to liquids at rest and has application in particular to the pressure of water against a dam or other restraining body; (b) hydraulics which considers liquid in motion, as, for example, the action which takes place through an orifice in the dam or restraining wall; and (c) hydrodynamics or hydro-mechanics, which discusses the effect of a stream in motion issuing, for example, from an orifice and acting upon a water wheel or other mechanical device.

Historically hydraulic engineering is among the most ancient of the recorded activities of men. The Egyptian engineers are known to have largely controlled the flow of the Nile and to have built canals and reservoirs whose magnitude caused them to be mistaken for works of nature. Almost innumerable works for storage and distribution of water to agricultural lands have been built in India and

Mesopotamia. Aqueducts, the remains of which still exist, were built by the Romans and other people of antiquity. Although a high degree of mechanical skill was developed in distributing the water supply to houses, baths and fountains, the principles of water measurement were not understood until within comparatively recent times. There is now a steady advance in experimentation to discover the laws which govern the movements of water under varying conditions, such as the form and character of material composing the channels or orifices along or through which the movements occur. The fundamental formula now accepted is that suggested by Chezy in 1775, $v = c\sqrt{rs}$, in which v represents the mean velocity of the fluid, r represents the hydraulic radius and s the slope of the surface. The value of c is determined by experiments. Kütter, a German scientist in 1868, from the results of data then available developed the formula, expressed in feet per second,

$$c = \frac{41.6 + \frac{.00281}{s} + \frac{1.811}{n}}{1 + \left\{41.6 + \frac{.00281}{s}\right\} \frac{n}{\sqrt{r}}}$$

The factor n termed the coefficient of roughness varies with the nature of the channel and its degree of smoothness. The values of n for channels of various types are as follows:

0.010	Planed lumber or plaster.
0.012	Smooth cement lined section.
0.015	Smooth brick or vitrified surface.
0.017	Rubble.
0.20	Firm trimmed soil.
0.225	Canals in good condition.
0.25	Canals in average condition.
0.275	Canals below average condition.
0.030	Canals in defective condition or rivers.
0.035	Very defective channels.

Municipal Supply.— At the present time the greatest activity in hydraulic engineering is in connection with procuring water, suitable in quality as well as quantity, for municipalities or similar communities. It is no longer considered advisable to take water directly from the flowing streams because of the widespread pollution of these due to increase of population. In most localities the treatment of the water by filtration must be undertaken, necessitating extensive works. The ideal condition for obtaining water for drinking and related purposes is from some elevated watershed which can be protected from intrusion and where the erosion of the soil may be prevented by the maintenance of forests or other suitable vegetation. Such conditions are found, for example, in the water supply of Portland, Ore., which obtains its water from a national forest. These favorable surroundings, however, are rare and in case of large cities such as New York and Boston it has been necessary to purchase large areas of land near the head water of small streams and build storage reservoirs, in some cases removing towns and factories in order to secure the necessary land and to ensure the purity of the supply. Among the more notable works are those of the city of Los Angeles, Cal., which brings its water supply from Owens Valley, a distance of upwards of 240 miles. As contrasted with this is the abundant supply of the city of Chicago, pumped from Lake Michigan, being obtained through tunnels extending out for several miles under the margin of the lake to avoid the pollution. This city discharges its sewage inland through the Illinois River which empties into the Mississippi near the intake of the Saint Louis waterworks, which utilizes, after filtration, the muddy and polluted waters received from the vast drainage area above.

There has been steady progress in the art of supplying water to towns during the past century and now the questions which the hydraulic engineer is required to consider in the design and construction of any waterworks embrace a great variety of subjects. It is necessary to consider:

1. The quantity of water likely to be needed. There is not yet any consensus of opinion among engineers on this point, the estimates varying from 100 to 150 gallons per day for each resident of the district to be supplied, at the expiration of 20 years from the inauguration of the supply. The prospective population is estimated from the records of past growth of the district and the growth of districts of similar character of occupation.

2. The possible sources whence the required quantity of water can be obtained, including the legal as well as physical limitations to its continued use.

3. The quantity of the water obtainable from each source, as regards its chemical constituents, in order to judge of its economical as well as its sanitary value. It sometimes happens that a water otherwise acceptable is so hard or contains in solution such quantities of various chemicals that the amount of soap required for washing with it is greatly in excess of that required by another water more difficult to procure, so much so that the cost to individual consumers for its constant use will be greater than the cost to the community of the introduction of the other supply.

4. The character of the water biologically; the number and nature of the organisms which are found in it. This is most important from the sanitary point of view. The identification of certain organisms as pathogenic or disease-producing marks a decided advance in sanitary science and is of great interest to the hydraulic engineer. It is found that the removal of the injurious organisms from water can be effected by filtration, and it now is considered to be the engineer's function to design or construct works for filtration through sand or other material which experiment proves to be adapted to the purpose.

5. The quantity of water obtainable from each source which appears generally suitable, the area of the watershed, the amount of annual rainfall upon it, the distribution of the rainfall through the year, the geological and topographical features of the surface, the wind movement and the range of temperature of the air, with especial reference to the probable evaporation losses, must all be taken into consideration. Whenever the minimum rate of daily run-off from the watershed exceeds the maximum daily consumption to be provided for, reservoirs must be constructed to retain the stream-water in times of excessive flow, and deliver the excess gradually as required.

6. The location of reservoirs requires a thorough acquaintance with the topography of the district, and their construction demands a high order of both theoretic and practical acquaintance with the action of water on various materials and with the form and method of their use. The construction of dams of earth, concrete and masonry has been the subject of careful study within the last few years, and the general principles have been fairly well established. There still remains a number of unsettled problems due largely to the progress of the mechanical arts and the introduction of new modes of construction, particularly of concrete and steel.

7. The means of conveying the water from the source to the point where it is to be used must be studied. The conditions of this problem are unlike those which are encountered in rivers, or in canals for either irrigation or navigation. A nearly uniform quantity of water must be continuously carried a long distance at as great a velocity as is consistent with safety and economy. It must be protected from loss by evaporation and by leakage of the channels, and kept free from pollution on its route. These conditions are best fulfilled by an enclosed conduit or pipe of masonry or metal, with a smooth interior surface. The relations between different values of *n*, which can be obtained by using different classes of material and of construction, and values of *c*, obtained by using different grades and alignments, have been for many years the subject of carefully conducted experiments by scientists. It is the function of the hydraulic engineer to apply to the special case he has in hand the use of the materials which are available and the mode of construction practicable in the case, in accordance with the latest results of scientific research. Up to the present time the best form and material for large conduits seem to be masonry or concrete, of horseshoe form, with smoothly plastered interior surface; or steel-plate circular pipes, with as few irregularities caused by rivet-heads as possible, sometimes lined with cement mortar and encased in concrete.

8. On reaching the point of distribution an entirely different set of conditions is encountered. The water heretofore concentrated in large masses has to be distributed over a wide area in a great number of small pipes in which orifices are opened and shut at irregular intervals of time; these pipes, moreover, are under a great head of water producing a pressure of 50 to 100 pounds per square inch, with consequently a high velocity of efflux from any orifice. The problem to be solved is so to arrange the connections and sizes of these pipes that, under the ordinary conditions of use, the pressure in the pipes will not be materially altered at any time, and a constant supply may be kept up in the entire system. As illustrating the magnitude and complication of the distributing system in a large city, the conditions existing in the city of Chicago may be cited. There were there, in 1916, in an area of 128,000 acres, 2,600 miles of pipes for the delivery of water, with 275,000 taps or orifices from which water is drawn at irregular intervals, 20,000 of these being controlled by meter. The development of such a system as this involves the exercise of not only theoretical knowledge of the principles governing the flow of water under all conditions, but also a thorough acquaintance with materials of construction and the methods of using them to produce the best results at the least expenditure.

Irrigation and Drainage.— Next in importance to municipal and domestic supply are the hydraulic engineering problems connected with the obtaining of an adequate quantity of water or the proper regulation of it to enable the production of food. Throughout the western two-fifths of the United States, on much of the best agricultural lands, the rainfall in insufficient in quantity, or so irregularly distributed throughout the year, that valuable crops cannot be produced with certainty without an artificial application of water. In the Mississippi Valley and to a certain extent in most of the States of the Union there are vast tracts of otherwise fertile lands which have an excess of water to a degree such that crops cannot be profitably raised. Here the hydraulic engineer. is called upon to solve the problems of drainage. In many respects these are similar to those of irrigation and are intimately connected with it as the object to be attained is the maintaining of the moisture in the soil within relatively narrow limits, for ordinary soils not dropping below 8 per cent of the volume nor rising above 15 per cent. There are also similar problems of providing adequate supply of water for cattle and other domestic animals used largely for food.

For the production of crops by irrigation or for relieving the lands of an excess of water by drainage, quantities of water must be handled which are relatively very large when compared with those needed for city supply. For example, a 160-acre farm will require for its irrigation or may need for drainage the handling of a volume of water as large as would be needed for domestic or general supplies if the area were covered with dwelling-houses or factories. When it is considered that an ordinary American city of say 100,000 persons covers an area of about 10,000 acres, while an irrigation or drainage project may include 100,000 acres or more, some conception may be had of the relative magnitude of the works needed for the two purposes. Although for irrigation or drainage there must be constructed works of large capacity, yet it is not practicable to pay for these works an amount comparable with the expenditures which may properly be incurred by a municipality. For farming purposes a cost of irrigation exceeding, say, $50 per acre or for drainage $20 per acre may be practically prohibitive, but for municipal supply the cost of providing water for a similar densely populated area may properly run into thousands of dollars. Thus the hydraulic engineer while encountering similar problems of quantity and quality of water, adequacy of supply and difficulties of storage and distribution, must keep down the cost of these irrigation or drainage works to a small fraction of that which is feasible in considering questions of municipal supply.

Extensive studies must be made by the hydraulic engineer and detailed maps prepared to show the topography of the country from which water may be obtained for irrigation and to which it may be carried. This mapping should be accompanied by measurements not only of the rainfall, wind movement and other meteorological phenomena, but especially of the flow of various streams at typical points on their course. Usually problems of flood conservation or water storage are involved, these being on a larger scale than those in connection with municipal supply. The result of these measurements of rainfall and run-off should be available for a considerable period of time, as the fluctuations during five consecutive years, particularly in the arid region, may not fully reveal the ordinary conditions. Ten years are better, but it appears from study of data now available that the engineer cannot assume to have complete knowledge of the climatic fluctuations from observations extending for a shorter period than half a century. Of course, it is impossible to wait that length of time before preparing plans for works, but when utilizing data which extends over a short period; a large factor of safety, especially with reference to extreme drought and flood, should be employed.

The United States government has recognized the necessity of furnishing data of this kind and has instituted through its Weather Bureau and Geological Survey series of observations of climatic factors and steam flow, which enable the hydraulic engineer to make his estimates with a fair degree of accuracy.

Rapid advances have been made throughout the United States, especially in the western or arid portions since 1900 in the construction of large storage reservoirs and distributing canals for bringing water to agricultural lands; so that in 1919 about 15,000,000 acres are under irrigation out of possibly 40,000,000 acres in all which may be watered. Also in other parts of the country drainage works have been provided for say 10,000,000 acres out of 70,000,000 acres needing such treatment to relieve the low lands of an excess of moisture. Large works have been and are being built in arid countries, notably in Egypt, India, South Africa and Australia by the British engineers. In other dry lands, notably in Spain and Italy, there has been a gradual development and in many cases restoration and enlargement of great works built centuries ago.

Disposal of Waste.— With the rapidly increasing density of population, the question of disposal of sewage from towns and cities is offering more and more intricate problems to the hydraulic engineer. In this he must call to his assistance the bacteriologist and chemist. Closely connected with the sewage problem is that of disposing of manufacturing or industrial wastes, especially where the custom has grown up of discharging these into the sewers or natural streams. Water is the universal carrier and solvent and of necessity must be largely employed in removing noxious materials.

The opinion has been advanced that the streams of the country should be preserved in their original purity and that each city or manufacturing establishment should be required to dispose of its sewage or waste in some other way than by using water as a carrier. Practically, however, it has been found that the natural streams must be used to a continually increasing degree in removing sewage, preferably of course after its more or less complete purification. The hydraulic engineer and his advisers are becoming expert in reducing the amount of pollution and in maintaining a high degree of purity in the effluent which escapes from the sewage or waste treatment works, and which flows away in the natural stream channels so that it will not be injurious to health or offensive to the senses.

Manufacturing.— The next large use of water with which the hydraulic engineer is concerned is in connection with manufacturing — this coming fourth in the scale of importance to human life, following after drinking water, food production and sewage or waste disposal. The problems in many respects are similar to those just enumerated as they are concerned with the provision of an adequate quantity and quality. In manufacturing water may be needed either for direct consumption or simply in washing or cooling. Included under this head is the use also of water for steam purposes in which case it must be free from mineral substances which would encrust the boiler or cause other deleterious action. For each purpose of manufacture there are certain requirements of purity, such, for example, in paper making where freedom from soluble matter is essential and where the hydraulic engineer and chemist must work together.

Water Power.— Next in importance after manufacturing is the employment of water in the production of power. As compared with other uses, the quality of water — its mineral contents or freedom from bacteriological life — is insignificant. What are required for power production are large volumes with steady flow and an adequate fall. The use of water for power is ordinarily compatible with its later employment for irrigation or in manufacturing — so that development of water power often goes hand in hand with the upbuilding of municipal supplies, irrigation works or other industries.

Through the United States the smaller water powers were sought and developed about a century ago but with the introduction of the steam engine these water powers were abandoned to a large extent and the cities which had originally been located near the water power gradually came to depend more and more upon the use of steam, while other cities built at more convenient railroad points have surpassed them in size and in manufacturing capacity. The immobility of water power and the former impracticability of transmitting power to any considerable distance from the water fall resulted in stagnation or even abandonment of the use of the water in power production. The situation was changed, however, by the invention of methods of electrical transmission of power. Since 1900 there has been a notable revival of interest in water-power development. Hydraulic engineers are being called upon to a greater extent than in the past to utilize the larger and more inaccessible streams of the country. Similar conditions prevail throughout the world and in localities such as in Norway and Sweden the water falls are now being developed and utilized by electrical transmission, the cheap power making possible the manufacture of certain chemicals, particularly the fixation of nitrogen from the air to form the basis of agricultural fertilizers.

In this branch of his work the hydraulic engineer enters largely into the field of hydromechanics as above defined, since he must study the mechanical effects which may be produced by utilizing the force exerted by water in motion to generate power. In hydraulic works, distinctively so called, the effort is constantly made to diminish the mechanical effect of the moving water so as to avoid injury to surfaces and substances unprepared to resist it. In hydrodynamic works the effort is made to concentrate all the power obtainable from the moving water and transmit it to machines which do effective work.

In the present state of hydraulic science more attention is being paid than ever before to the obtaining of closely accurate results of experiments conducted by skilled observers, in which the aid of electricity is used to register all phenomena in a manner never possible heretofore. Great as the advantages have been during the last 25 or 30 years, equal or greater progress in the elucidation and practical application of principles may be expected within the next quarter of a century.

Navigation.— The least in present importance to mankind but the first in historic development of industries is the use of water in inland navigation. Railroads have increased to such an extent that the use of the rivers and lakes for transporting persons and products, while still important, is relatively far less so than in former years. Civilization can expand and succeed if there is an adequate supply of water for the purposes before mentioned, even if navigation is not employed, as goods can be transported by rail with a high degree of economy. Up to the first half of the 19th century, however, water transportation was of prime importance as communication by land was slow and in places almost impracticable. On the other hand the relatively sparse population and undeveloped condition of industries offered few hydraulic problems. It thus resulted that in the Constitution of the United States, while the rights of navigation are protected, there is practically no provision made for other uses of water. What are now found to be the more pressing needs of communities in regard to water supply required for domestic and municipal purposes, for irrigation, for disposal of wastes, for manufacturing or for power purposes — have come forward prominently since the Constitution was adopted. Particularly with reference to interstate waters there is much uncertainty in Federal and State laws, hampering the work of the engineer.

Navigation upon the ocean is, of course, of vital importance to the nations of the world and hydraulic engineering works having to do with harbors are being built of rapidly increasing magnitude as the size of the ships increase, but with respect to the inland passages and rivers there has been rapid decline of their use in navigation, such that, outside of the operations of the corps of engineers of the United States army, few advances have been made. There are indications, however, that a change is about to take place and that with the development of different types of barge and of modified power boats, the rivers upon which navigation has practically ceased will be more generally employed and there will be a larger demand for works for their regulation and control for purposes of navigation.

As a notable exception in the general decline of interest in inland navigation should be cited the expenditures being made in enlarging and changing the alignment of the Erie Canal from the vicinity of Buffalo, N. Y., east to Albany and the connecting canal to Lake Champlain. Over $100,000,000 was appropriated by the legislature of New York State for changing the old waterway into a barge canal capable of navigation by boats drawing nine feet of water. Later appropriations have been made and notable hydraulic works executed. There have also been large expenditures made by the Federal government for the improvement of the channels connecting the Great Lakes. On these the conditions are more nearly comparable to ocean navigation; the freight traffic, principally of iron ore, coal and grain on Sault Sainte Marie and Detroit River surpasses that of the Suez Canal.

Harbors.— An interesting and important branch of hydraulic engineering is that which deals with larger masses of water than any of those so far considered. Along the sea-coasts of all countries there are places where the conformation of the shore and the nature of the contiguous lands render the creation of harbors desirable, but where the tidal waves and littoral currents come in conflict in such a way as to make the approach from the sea dangerous to vessels. To lessen the destructive effects of the great masses of water in motion, impelled by either the wind or the tidal currents, breakwaters or piers of stone projecting from the shore are built with good results. The massiveness which such structures are required to possess may be judged from the fact that it has been learned that the foundation for a breakwater must extend out to where there is from 18 to 20 feet of water at low tide; that the height of the waves by which it is likely to be assailed may be from 10 to 20 feet; and that the impact of the wave on the opposing structure may be as high as 6,000 pounds to the square foot. In the open sea it is not likely that waves as high as this are formed, or that the force exerted by them is nearly as great, but the problem of the form and resisting power of the hull of ships has to be considered from the standpoint of the dynamic effect of the water which is impelled by the wind and waves against the hull, as well as the resistance offered by the water to the passage of the hull through it.

Floods.— Each stream in a state of nature fluctuates in accordance with the rapid changes of weather and alternates between high and low water, having usually a spring flood due to increased temperature, the melting of snow and frequent rains. The factors which combine to produce floods vary in intensity from year to year; occasionally the combination of extraordinary rains on frozen ground or with rapidly melting snow produces flood of exceptional violence. During their geological history the streams during high water periods have built up flood plains by deposits from the muddy waters. Such lands are of exceptional fertility and their level character has invited settlement. The tendency has been not merely to cultivate these lands but to build manufacturing establishments, railroads and towns upon the level surface. During periods of low water or even of ordinary flood there is no difficulty, but at times of high flood, the bridges, factories and other buildings along the bank interfere with the free flow. The river of necessity at such times spreads out and endeavors to take possession of its ancient flood plain, with consequent destruction to property or even life. The immediate answer to questions, which are presented to the hydraulic engineer by these flood conditions, is to remove from the river channel and the flood plain the obstructions placed there by man and to erect permanent buildings only on higher ground, saving the low land for such agricultural purposes as will not be seriously injured by the occasional floods. This, however, has often become impracticable and it is necessary to consider other solutions for the many flood problems. In attacking these there are two lines of effort: First, flood prevention; second, flood protection.

In flood prevention the remedy is to be sought by careful surveys and examinations on the drainage basin to discover possible reservoir sites and by storing the flood water in suitable basins, enlarging the natural ponds or lakes or making artificial reservoirs where the floods may be restrained for a period of days or weeks, the excess being let out slowly in accordance with the capacity of the channel to receive it. There are not many localities where adequate reservoir capacities have been provided by nature or where dams can be erected creating a reservoir at a cost commensurate with the immediate benefits. Investigations have been made, however, and it is evident that in the future many reservoirs will be constructed to reduce the flood crest.

In flood protection the object sought is to build near the points of danger large dykes or walls, shutting off the river from its ancient flood plain, and confining it in a relatively narrow channel. This is the most immediate and direct method of solving the difficulties for any particular locality, but of course does not assist other threatened points as in the case of reservoirs or similar works built for flood prevention. In fact the protection of one area may jeopardize another by increasing the flood heights. The combination of flood protection by reservoirs and of flood prevention by dykes offers many interesting problems and is the subject of continued study by engineers in many parts of the world.

River Regulation.— All these hydraulic engineering problems of (a) domestic and municipal supply, (b) irrigation and drainage, (c) disposal of sewage and waste, (d) manufacturing, (e) water power, (f) navigation, (g) flood protection and prevention, may be considered as part of the general hydraulic engineering problem of river regulation. As a rule each of these items has come up as a separate matter to be handled by the hydraulic engineer within certain territorial limits or restrictions of funds available. The artificial restriction of property lines, or of State or other boundaries, have usually prevented any broad consideration of the subject, but it is obvious that for the full development of any country each river system must be considered as a whole and examined, beginning at its head waters, with the intent of utilizing all possible storage reservoirs for holding water for municipal supply, irrigation, water power or flood prevention — considering in this connection also the forest cover and cultural conditions of the drainage area. There should be studied also the requirements of disposing of sewage and manufacturing waste, the employment of water for manufacturing and water power and finally in its lower courses its use for navigation. Regulation in the interest of the commonwealth demands broad consideration of all such problems by qualified hydraulic engineers and requires a broad control, usually by national authorities, because of the fact that the larger river systems are independent of artificially drawn State lines.

In river regulation in general and in the individual problems a wide field is thus offered to the engineer. The capacity and arrangement of storage reservoirs must be proportioned to the fluctuations of the natural flow of the stream. The channels for the conveyance of the water must be proportioned for the various proposed uses and with reference to the materials of which they are composed. When used for irrigation a low velocity of flow is desirable to avoid abrasions of the banks, and the sizes of the channel are proportioned to convey definite quantities of water steadily. In other cases the channels must be maintained in such manner as to carry constantly varying quantities of water at different speeds of current, and the banks must be fortified against injury from sudden fluctuations of level in the water surface and from abrasion by floating material or accretion by deposit.

The construction of levees or embankments along the banks of a river and parallel to its current is the earliest and simplest of the methods of river improvement; but it is only within the last half century that this has been reduced to a science, and the most effective and economical methods of design and construction formulated. If the stream improved is of sufficient size to be navigable, the conditions of the problem are again changed. The course of the channel in places may have to be altered to avoid rapids of too steep descent for passage of boats, and a sufficient depth of water must be maintained at all times and in all places for boats of definite dimensions and draft. Where such artificial channels are necessary it is important that they should be so proportioned that the passage of the largest boat at the maximum permissible speed should not create a wave which would injure the banks or retard the progress of the boat.

The problem of the resistance of the water to a vessel passing through it enters into the consideration of navigation, especially of canals and inland waters. The more rapidly a vessel passes through a small channel the greater is the work to be done in the displacement of the bulk of water occupied by the hull. The displaced water is prevented from flowing off by the adjacent banks and shallow bottom, and the pressure required to propel the boat is so increased that it is found that a greater velocity than three miles per hour is not economical. All such factors must be listed for consideration in the general plans for improvement of inland waters.

From the above review of hydraulic engineering it is to be noted that it is a profession which has numerous ramifications and underlies the health, comfort and prosperity of the human race to a greater and greater degree as population and industry increase. Each year is showing notable advances in methods and results of work. The literature on the subject is already voluminous and each month shows some notable contribution either in the proceedings of engineering and scientific societies or in textbooks or treatises on one or another of its many details. See Hydraulics; Hydrostatics; Hydrodynamics; Hydro-Electric Development.

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HYDRAULIC MACHINERY, machinery which is operated by water pressure, either natural or transmitted: natural, as in a pipe leading down from an elevated reservoir; transmitted, when the pressure is produced by an engine, such as a pump or a hydraulic ram. The more powerful hydraulic machines are worked through an «accumulator,» which acts as a governor. This device substitutes a uniformly acting weight for the fitful variation of impulse inseparable from pumps and natural sources. It consists essentially of a piston held down by heavy weights, acting in a cylinder into which the water supply is led below the piston. The water under pressure pours into the cylinder, lifting the piston and its weights. If the impulse is much greater than the weight, the pressure in the cylinder does not change, but the piston is driven higher. The machine is operated by water taken from the cylinder at the constant pressure represented by the weight. The smaller the area of the piston in proportion to the weight the greater the pressure per square inch available to run the machinery.

Hydraulic machines include metal working machinery like presses for corrugating and stamping, punches, shears, rivetters, bending machines, etc.; many kinds of cranes, lifts and elevators; hay and goods presses; jacks, pumps, capstans, and winches; railway switches and turntables; drydocks; gun brakes to take up the recoil of guns when fired, and gun lifts to raise disappearing guns to the firing position; door-closing mechanism for closing safety doors in bulkheads on shipboard; grain elevators and dredges; and similar power applications. (See Hydraulics; Hydraulic Engine; Hydrodynamics). Consult Butler, E., ‘Modern Pumping and Hydraulic Machinery’ (London 1913); Dunkerley, S., ‘Hydraulics’ (2 vols., London 1907); Gibson, A. H., ‘Hydraulics and Its Applications’ (New York 1915); Merriman, M., ‘Treatise on Hydraulics’ (New York 1916); Robinson, H., ‘Hydraulic Power and Hydraulic Machinery’ (London 1912); Slocum, S. E., ‘Elements of Hydraulics’ (New York 1917).

HYDRAULIC MINING. See Gold Mining.

HYDRAULIC PRESS. The action of the hydraulic press depends on two facts concerning water: (1) that it is incompressible; (2) that when confined it will transmit equally in all directions any pressure to which it is subjected. The hydraulic press by which these facts are put to economic use consists essentially of two connected cylinders, one of large diameter and the other of small diameter. Each is fitted with a piston. The smaller cylinder is operated as a pump, the larger one as a reservoir. Any pressure per square inch put upon the pump piston is transmitted to the reservoir piston per square inch. Thus, if the pump piston has an area of two square inches, and the reservoir piston an area of sixty square inches, a pressure of 80 pounds on the pump piston rod will exert a pressure of 2,400 pounds on the reservoir piston rod. As applied industrially, the hydraulic press carries a platen, or platform, on the upper end of the reservoir piston rod — generally a plunger of large diameter. A massive frame work extends from the base of the reservoir cylinder up and overhead, and upon this is fastened a fixed platen opposite the moving platen. The material to be pressed is placed on the movable platen below and is forced up against the upper platen by pumping water with the pump cylinder into the reservoir cylinder below its piston. The efficiency of the hydraulic press is very high — above 90 per cent; that is, less than 10 per cent of the power put into the machine is absorbed by the friction developed in operating it.

The principle of the hydraulic press is made use of in the portable hydraulic jack, used in raising heavy vehicles, and even great buildings, bridges, etc. The hydraulic cranes used for lifting heavy castings and machines, such as locomotives, is a development of the hydraulic press. Perhaps the most common application of the hydraulic press is in the gaining of oil from oil-seeds and oil-nuts. These require the immense pressures long continued which the hydraulic press supplies. Another use is in forcing into place the metal hoops on large and strong barrels. A very interesting application of the hydraulic press is in the making of lead and tin pipes. These metals become plastic under the tremendous pressures exerted, and flow out of the prepared orifices in the same way that macaroni is forced from the machine in which it is made by a very moderate pressure upon the soft dough. By an ingenious device lead pipe lined with tin is as readily produced as the plain lead pipe. The hydraulic press is also used to coat electric cables with lead, the cable passing through the core stem which preserves the hollow when lead pipe is made. Still another application of major importance is the use by engineers of the hydraulic press in tunneling, the shield through which the excavations are made being forced forward into the new excavation by six (usually) hydraulic presses butting against false work in the completed part of the tunnel.

HYDRAULIC RAM, an automatic machine generally employed to lift water from a low level to a higher one, but also to supply compressed air for motor purposes. The hydraulic ram operates by the momentum of a body of falling water. It consists essentially of a large pipe sloping downhill, the lower end rounding upward and being fitted with a heavy drop valve; and a small pipe reaching uphill to the point where the water is to be delivered. Back a few inches from the lower extremity of the pipe is attached an air-chamber connecting with the body of the pipe by an ordinary lift valve. The exit valve or «pulse valve,» as it is called, having dropped by gravity below its seat, the water in the drive pipe flowing down from the reservoir out of the exit gathers increasing velocity, and therefore momentum, until it is strong enough to lift the exit valve to its seat and close it. The column of water in the drive pipe being thus suddenly halted exerts a pressure all about it equal to its momentum at the moment it was stopped. This pressure operating on the valve into the air chamber opens it and a part of the water rushes into the air chamber, compressing the air within, until the pressure of the compressed air balances the pressure of the checked stream in the drive pipe. The force which closed the exit valve being thus greatly reduced, that valve drops down again from its seat, and the stream of water begins flowing again from the exit. This cycle is continuously repeated. The lift pipe is connected with the lower part of the air-chamber just above the inlet valve. When the latter closes in the balancing of the air pressure, the water entering the lift pipe is forced upward until its weight balances the air pressure. As but a small proportion of the water running in the drive pipe enters the air-chamber, the lift pipe is always much smaller in diameter than the drive pipe.

It is evident that the pulse valve must be designed or regulated to suit the momentum of the water with which it is to operate: if it is too heavy it will not close at all, and the ram will not work; if too light, it will close before the stream in the drive pipe has attained its full force, and the result will be that so little water will enter the air-chamber that there will be practically no air pressure developed to lift the water in the lift pipe. The newer types of rams have a balanced lever with a sliding weight connected with the exit valve so that it may be adjusted with great delicacy to the available water power. The efficiency of the hydraulic ram depends upon the momentum of the flow of water in the drive pipe — that is, to its velocity multiplied by its mass. The velocity being dependent on the vertical fall or head of water available, greater power at the ram is gained by increasing the mass of water moving in the drive pipe, by making it larger in diameter or longer. This will mean that more water will flow into the air-chamber when the current is halted, and thus the air be compressed to a greater degree, and consequently a higher or larger lift of water attained in the lift pipe. The formulas in common use by engineers for calculating the diameter and length of the drive pipe for any given conditions are as follows:

Diameter of drive pipe $=\sqrt{1.63\times M}$ where M is the volume of water continuously available in cubic feet.

Length of drive pipe$=H+h+\dfrac{h}{H}\times 2$ where H is the fall (perpendicularly) of the drive pipe, and h the height to which the water is to be carried in the lift pipe.

One of the difficulties to be guarded against in the operation of the hydraulic ram is the gradual absorption of the air in the air-chamber by the water continually flowing through. Water under pressure dissolves a considerable quantity of air, and this has to be replaced, or the air cushion would become too small to be effective. An attachment to keep a sufficient supply of air always in the air-chamber is a low standpipe connected with the drive pipe at its base and to the air-chamber from its top, with suitable valves to take air from outside at low pressures, and force it into the air-chamber at high pressures.

The more common use of the hydraulic ram is to supply water from a lower level to a country house or dairy upon an elevation near by. It is also used by builders to get a water supply on the upper floors of new buildings where the water service fails. In the boring of the Mont Cenis tunnel the engineers used hydraulic rams to compress air to drive the rock drills employed, the compressed air being taken from the top of the air-chamber direct. The water power operating the rams was the natural drainage of the tunnel.

The pumping ram is designed to raise a water supply separate from that which operates the machine, so that water that is not fit to drink may be used to deliver a supply of wholesome water through the lift pipe. In this form of ram the momentum of the checked flow of water in the drive pipe expends its force upon a large area piston of a pump working in the lift pipe.

An industrial application of the principle of the hydraulic ram is made in the machine known as the "hydraulic ram accumulator," a device for storing water under great pressure, in some cases reaching 1,000 pounds per square inch. Consult Bradley, F. A., 'Pumping and Water Power' (London 1912); Clarke, J. W., 'Hydraulic Rams' (London 1907); Hutton, W., 'Country Plumbing Practice' (New York 1914); Kennedy, R., 'Modern Engines' (London 1912).

HYDRAULIC TRANSMISSION. The fact that water confined within an unyielding encasement transmits equally in all directions any pressure put upon it gives rise to the principle of hydraulic transmission — the transference of power by means of a column of water under pressure. In the industrial application of this idea the column of water is held in a pipe, which may be vertical, horizontal, inclined or in any combination of these positions: wherever the water reaches, the pressure under which it has been placed is available as power at any point of the pipe line. In large cities this principle is made use of for supplying many power users from central stations by means of water pipes laid in the streets. London has the largest development of this form of power transmission, having upwards of 150 miles of pressure mains, some of them seven inches in diameter, carrying water under 750 pounds to the square inch. At Glasgow and Manchester the pressure carried is 1,120 pounds to the square inch. Many other British cities have similar hydraulic power service. The pressure upon the water is supplied by steam pumps at the central stations. The steam is used expansively in high and low pressure cylinders working directly upon single-acting pumps of small diameter. The action is a direct reversal of the hydraulic press (q.v.). The water from the pumps is forced into storage cylinders known as hydraulic accumulators. These cylinders are fitted with pistons which are weighted with loads per square inch equal to the pressure the confined water is to carry. The water from the pumps enters at the bottom of the accumulator at a little higher pressure than is represented by the weight, and lifts the piston with its load, thus storing power in proportion to the amount of the confined water. In the case of the London service the pressure in the steam cylinders is 80 pounds to the square inch, and in the accumulators 800 pounds to the square inch — the areas of the steam cylinders to the pump cylinders being as 10 to 1. The high pressure power is used generally through Pelton wheels. The cost of hydraulic power in London is equivalent to about five cents per horse power per hour — from 30 to 60 per cent less than the cost of electric power.

The natural gravity pressure of water in pipe lines leading from elevated reservoirs is equally available for power, and is usually passed through an accumulator to render the pressure uniform. Each 32 feet of elevation contributes about 14 pounds pressure to the square inch.

HYDRAULICS, that branch of engineering science which deals with liquids (especially water) in motion, the regulation of the flow of liquids, and utilization of the momentum, pressure, weight, etc., as when confined in pipes and channels, for the operation of machinery, or doing useful work.

Water being the most common liquid, and having considerable weight (62½ pounds to the cubic foot), is excellently adapted to do work by its gravity. When allowed to run it acquires momentum, a quality available for the convenient use of the designer of hydraulic mechanisms. Being of very slight elasticity, that is, practically incompressible, it can be used when confined with great advantage, as we note in the hydraulic press and similar machines. Flowing as it does in streams, in almost every locality, it is comparatively easy to direct it for the service of man.

The density of water is apparent from the fact that it supports heavily laden ships, and from the tremendous power with which large waves driven at great velocity by high winds beat upon a shore or breakwater, exerting a pressure in the case of a 30-foot wave of 7,000 pounds per square foot. This density will be better appreciated after studying this table showing

THE DENSITY OF WATER.

Temperature		Weight per cubic foot	Comparative density
Fahr.	Cent.		
32°	0°	62.417	.999884
37.4	3	62.424	1.000004
41	5	62.423	1.000003
50	10	62.409	.999760
59	15	62.373	.999173
68	20	62.316	.998272
104	40	61.947	.992366
167	75	60.863	.974999
212	100	59.844	.958666

Sea water will weigh about one and a half pounds more than fresh water, on which the above table is based. Ice loses weight, or expands on freezing, weighing 57.28 pounds to the cubic foot. A cubic foot of water equals 7.48 United States gallons; a liter of water equals 0.264 United States gallons.

The volume and speed of flowing water in a stream constitutes its theoretical utility. To calculate the horse power available in a stream, it is first necessary to know its cross section. If it can be determined that the average depth is five feet and the average width 50 feet, then the cross section is 250 square feet. If the water flows three miles an hour, that is 264 feet a minute or 4.4 feet per second. Since 33,000 pounds raised one foot in a minute is the horse power equivalent, it is obvious that this gives a basis for figuring the horse power. If a dam is built, there will be normally 250×264 cubic feet of water weighing 62½ pounds per foot coming over the dam every minute, that is, 4,114,000 pounds, a potential of nearly 125 horse power. This water to be utilized may be conveyed by a level mill race to a point where it can fall over an overshot waterwheel, and thus be made to yield from 70 to 90 per cent of its potential horse power, depending upon the mechanical efficiency of the wheel. If the same water were taken from the bottom of the dam to operate a turbine wheel a higher efficiency would be gained. Such a large volume of water as that supposed — 1,000 cubic feet per second would suffice to run several ordinary wheels.

The actual horse power developed will be considerably less than the theoretical, owing to friction and imperfect machinery. About 75 per cent of the theoretical is generally considered as available for use in practice. Since no stream flows uniformly, and since the power will be used intermittently, it is obviously necessary to provide a large storage reservoir for the power plant if the approximate value of the power is to be obtained. The engineer must therefore calculate how large a dam he needs and can build in that locality, and what it will cost, and how high this dam should be.

If the water in a stream is to be led away in a pipe, it is necessary to figure the carrying capacity of the pipe, for which the following table is useful:

VELOCITIES OF WATER THROUGH PIPES.
(In feet per second)

Diameter of pipe in inches	Gallons flowing per minute					
	100	200	300	400	500	1000
3	4.54	9.08	13.62	.....	.....	.....
4	2.55	5.11	7.76	10.21	12.17	.....
5	1.63	3.27	4.90	6.54	8.17	.....
6	1.14	2.27	3.40	4.54	5.67	11.35
7	0.83	1.67	2.50	3.34	4.17	8.34
8	0.64	1.28	1.92	2.55	3.19	6.38
9	0.50	1.01	1.51	2.02	2.52	5.04
10	.....	0.82	1.23	1.63	2.04	4.09
15	.....	.....	0.55	0.73	1.09	1.82
20	.....	.....	.....	0.40	0.62	1.02
30	.....	.....	.....	.....	.....	0.45

The above figures are to be taken as approximate, because in each actual case there will be differences of friction, depending on the roughness of the interior of the pipe.

Water moving through a pipe at a certain velocity acquires momentum — that is the velocity multiplied by its weight. When water is suddenly stopped in a pipe it delivers a blow that is called water-hammer, or more properly water-hammering. In a large or long pipe with rapid flow this momentum may be strong enough to rupture the pipe, hence it is extremely dangerous to shut off suddenly the flow in a large pipe. A similar effect is produced in pipes carrying great head. In one reported instance the sudden closing of an automatically balanced valve in a short 42 inch pipe, under a head of 25 feet, caused a hammer equivalent to a head of 250 feet, and sprung the rivets, causing a leak in a ¼-inch steel casing. In another instance, with a 24-inch pipe, a valve was closed by hand in 20 seconds, and the pressure, measured 2,100 feet away, was found to oscillate a number of times between the extremes of 40 and 65 pounds.

It is obvious that the first use of water for mechanical purposes involved leading the water from a stream or other source, for use at another place. A primitive mechanism for raising water from a stream was the noria, consisting of a large upright framework like a wheel, placed over a stream or river so that the flow of the current turned it around on its axis. To the periphery of the wheel were attached hinged buckets. which were often earthen jars tied on the frame, and which were partly filled as they dipped in the stream, and being carried to the top were emptied by a tripping device into a trough, which led the water away on the higher level.

When men began to use machinery, as for grinding wheat, a better mechanism than the noria was necessary, and they learned to dam a stream and secure a fall of water to drive the wheel, which was provided with cross boards, so as to give the water a surface to push against. When the water struck the wheel on top, pushing with both its weight and velocity, it was an overshot wheel; if it passed under it was an undershot wheel; if the water struck the wheel just below the level of the shaft it was a breast wheel; when the wheel was mounted on its side rotating on an upright shaft, with spiral or curved flanges for buckets, it was a tub-wheel, which form is the progenitor of the turbine. Overshot and undershot wheels were used for hundreds of years to drive flour mills, and a few are still in use, but such wheels are very wasteful of water, as compared with modern constructions.

Flow of Water Through Orifices.— A large and important section of the science of hydraulics is that which treats of the study of the flow of water through orifices of varying shapes and sizes and under varying heads. From these studies has come the knowledge which guides the mechanic in the proper formation of a nozzle suitable to the economical and efficient delivery of a certain amount of water under the pressure of any given head. Experiments in this direction are carried on by passing the water through an opening in a thin plate. Careful measurements of the spouting jet give a very close idea of its natural form. In this way the observed contraction of the jet just after issuing from the opening has led to the use by water-supply engineers of an entrance tube, or «mouthpiece» of modified funnel-shape placed within the reservoir, in the case of the supply pipe leading out of a reservoir. Outside of this mouthpiece the pipe is gradually expanded into an elongated funnel or «adjutage.» The effect of these modifications has been to increase the velocity and consequently the discharge from the reservoir into the pipe to, in some cases, twice the volume to be theoretically expected from the existing head of water in the reservoir.

Another economic result from the study of the jet from an orifice is in the formation of hose nozzles for fire service, where the aim is to produce a jet of the largest possible volume and velocity with the smallest amount of friction.

Flow of Water in Channels.— In the practical applications of hydraulics, water is conveyed to a place where it is to do work, in open channels or in pipes. In the case of the former the velocity or speed of the current depends solely on the grade of the bottom of the channel. The water simply «runs down hill,» and the steeper the grade the swifter the current. The material in which the channel is formed will control the grade it is possible to give the canal or ditch, as too high a velocity for the water will tend to destroy the channel. So where the channel is simply cut in the natural earth the grade is perforce made safe for the material. A water velocity of three inches per second will carry off fine clay; at six inches per second, ordinary soil will be carried away; at one foot per second, coarse sand will run off; at two feet per second, gravel washes away; at six feet per second, large stones will be rolled along. It is customary, therefore, to line a channel with some enduring material, such as concrete, or even masonry if it is to be permanent. The flow of water in these channels will obviously be affected by the friction at the bottom and sides of the channel. This is technically known as the «wetted perimeter» and is measured on the cross-section of the stream. All along these edges of the flowing body of water the stream is held back, the normal speed of the current being found only toward the centre and near the surface. The action of wind may serve to retard or advance the surface velocity. So it becomes a matter of considerable intricacy to determine just how much water will be delivered and at what velocity, by a given stream flowing down a given grade. A great number of formulas have been proposed by different engineers to aid in making such calculations, and these are to be found in the technical textbooks on hydraulics.

Flow of Water in Pipes.— When the flowing stream of water is completely enclosed, as in a pipe, it is evident that no attention need be paid to the grade. The pipe may stand vertical if so desired. The difference in level vertically between the intake of water at the upper end of the pipe and the point of discharge is called the «head.» It is expressed in feet, but in practice it is translated into pressure — the pressure equivalent to the weight of a column of water having the area of the pipe and a height equal to the head.

The friction set up by the perimeter of a pipe filled with running water is very considerable, and as soon as the lower end of the pipe is opened and the water is allowed to flow the pressure corresponding to the head disappears by a large percentage. This is called technically «loss of head.» Its effect is to cut down the velocity of the stream in the pipe, and hence, to reduce the theoretical discharge very materially. Several «laws» have been deduced from a number of experiments made under these conditions. They are:

(1) The loss of head from friction is directly proportional to the length of the pipe. (2) It is inversely proportional to the diameter of the pipe. (3) It increases nearly as the square of the actual velocity of the stream in the pipe. (4) It increases with the interior roughness of the pipe. Another source of loss of head is to be found in every bend of the pipe. This is greater as the velocity is large, and is very small when the current is very slow.

From the first two laws above quoted it is seen that the discharge of water from a pipe must depend upon the proportion of the length to the diameter. Hydraulic engineers are accustomed to classify pipes as "short" and "long." A short pipe is one whose length is less than 500 times its diameter; a long pipe is one whose length is more than 500 times its diameter. In a short pipe the loss of velocity due to friction is so small as to be negligible in practical work. In a long pipe, on the contrary, particularly if of very small proportional diameter, the friction is sometimes great enough practically to nullify the velocity and reduce the discharge to a mere trickle. As an example it may be stated that experiment has proved that one pipe of 24 inches diameter (452 square inches in area) will discharge as much water as 32 pipes of 6 inches in diameter (904 square inches in combined area). That is, the advantage of half of the area of the smaller pipes was lost by the friction of the larger perimeter surface. This matter assumes great importance in designing water-supply systems for cities, where the apportionment of the large mains and the small supply pipes must be directed to conserving the "head" or force of the flow against its too great diminution by "long-pipe" friction.

Hydraulic Gradient.— Another phenomenon which presents itself in the problem of the water-supply engineer is what is known as the "hydraulic gradient." This is a grade line assumed under the influence of the varying pressure by a body of water flowing in a pipe toward a lower level. It is ascertained experimentally by inserting in such a pipe a series of vertical tubes freely open to the atmosphere, and reaching upward to the level of the water in the supply reservoir. If the water in the pipe were not flowing, it is evident that in all the tubes the water would stand at the same level — that of the water in the reservoir. Upon allowing the water to flow, however, the water in the upright tubes falls, not to a uniform level, but to a graded line. In the tube nearest the reservoir it falls least; in the tube farthest from the reservoir it falls most. A line connecting the points at which the water stands in all of the tubes is the hydraulic gradient for that particular pipe.

The hydraulic gradient will vary according to the diameter of the pipe, its length, the grades on which it is laid, the roughnesses of its interior, its expansions or contractions in diameter and the distances from the reservoir at which they occur, and the number and sharpness of the bends placed in the system. The application of the principle of the hydraulic gradient in water-supply work appears when it becomes necessary or desirable to carry a supply pipe over a hill, which, though it be on a lower level than the water in the reservoir, may be above the line of the hydraulic gradient. In this case a siphon must be formed, otherwise the water supply will be cut off from the hill and the pipe line beyond it. See SIPHON.

Hydraulic Power.— Reference has already been made to the potential power for work by water stored at a height above the level where it is to be used. This power is exercised only in case the water is allowed to move. The power developed is that of the weight of the water used multiplied by the speed or velocity at which it moves; this product being termed its "momentum." From the previous discussions it is seen that in making use of moving water a much greater power can be secured by confining it in pipes than by conducting it in open channels. In the latter case, while the weight of the water used may be the same, the velocity factor in the momentum is quite small, whereas in a pipe it may be very large if the grade of the pipe is steep. So that a small quantity of water operating under a great head may be made to do much more work than a large quantity with practically no head at all, as in the case of an open channel. For this reason the open water water-wheels are much less efficient with the same volume of water than the enclosed Pelton and turbine wheels operated by pipe lines.

The Turbine Wheel.— An overshot wheel is unscientific, because it carries a small part of the water beyond its lowest point, back on to the rising side of the wheel, where its weight is opposed to the forward movement; the undershot wheel gets the push of the water during only a small part of its revolution, and also carries up waste water. The best construction aims to throw the water quick and hard into the wheel and get it out again without dragging on the wheel. The theoretically best construction has been found in the turbine wheel, which is fundamentally a wheel rotating on its sides, on a perpendicular or upright axis, and taking in water at the sides, from gates in a stationary case, which admit the water at a desirable angle so that it strikes the curved blades of the runner or running wheel, gives them a quick thrust and falls through, delivering usually at the centre. It should be here noted that in English and Continental usage all water wheels are called turbines, while in American usage the word turbine is reserved for the style of water wheel just described, having spiraled flanges and runners. The turbine has been built in many forms, in the endeavor to secure the most power from the flowing water. The style which has become most common is the impulse or action turbine, having stationary gates with curved guides that direct the flow of water. Immediately below is the runner, having flanges curved but substantially at right angles to the fixed guides, so that the water delivers a push to the runner, and falls down, perhaps to a second, third or fourth runner. This developed type is now commonly called the Francis turbine, after an engineer who developed it about 1850. The reaction turbine has spiral-shaped flanges positioned to receive the water axially and deliver it tangentially.

The turbine is now almost universally adopted for all water powers of low head, that is under 300 feet head. It should be understood that "head" signifies the height of the source of water above the point where it enters the turbine or other water wheel. This head gives a pressure the equivalent of the weight of a column of water of that height, or slightly less, owing to the friction of the tube or container.

Impulse or Pelton Wheels.— The impulse or direct-action wheel, after going through evolutionary development as overshot, undershot, breast wheel, etc., has settled into the form known as the Pelton wheel as the best type. It is in almost universal use for high heads of 500 feet and over and in hydraulic street service. It is named after L. A. Pelton, because he did more than any other man to perfect the dividing wedge principle, which serves to direct the water to the best advantage, securing the highest efficiency deemed possible with a direct-impulse wheel. The Pelton is a wheel in its simplest form, usually rotating on a horizontal axis, having buckets bolted to its periphery, against which the impelling water is directed from one or more nozzles. The buckets are like twin hollowed hemispheres or half-globes that are pushed together so that they divide by a straight line and sharp edge. The jet from the nozzle is aimed directly at this dividing ridge, which separates the water and gives it a direction that tends to throw it out of the hemispherical twin buckets as soon as it has done its work. The impulse wheel for utilizing high heads of water was first introduced by the California miners of 1850, and gradually improved, Pelton doing his work about 1878 to 1880. In modern practice the construction has improved. See Hydro-electric Development.

The Pelton wheel is not quite as efficient theoretically as a turbine, wasting from 5 to 7 per cent more water; a Francis turbine will deliver more water for the same diameter than a Pelton. But the turbines are more complicated and more costly, and not so well adapted to receive the enormous pressures to which Peltons are subjected under a high head. For many years a three-foot Pelton wheel was run at the California and Consolidated Virginia mine in Nevada, under a 2,100-foot head with a little half-inch stream of water, making 1,150 revolutions per minute, or the equivalent of 240 miles an hour, and delivering 100 horse power. They are built in sizes up to 10,000 or more horse power, and use from one to four nozzles distributed around the periphery, the tendency being to employ one nozzle. Some of the larger nozzles deliver a stream of 9 or 10 inches diameter. This flow is regulated by a central «needle» which can be advanced to partially close the aperture of the nozzle. Deflectors are also employed to turn aside the flow of water should the «load» be suddenly reduced. Both turbines and Peltons are now commonly coupled directly to dynamos for generating electricity, that the power may be sent out on wires, or the current used for electric lighting, etc.

Pumps.— To comprehend the action of pumps the reader must understand that water always seeks the lowest possible level. If a garden hose is nearly filled with water and the two ends are held up, it may be demonstrated that the level of the water in one end is the same as the other end; this crude device is sometimes used in making grades for drains. It must also be borne in mind that water is under atmospheric pressure. The air weighs 14.7 pounds per square inch (at sea-level), and if the lower end of a pipe of one inch cross section be placed in water, and the air be pumped out or otherwise removed from the pipe, the water, being relieved of 14.7 pounds pressure, at once rises in the pipe until the column of water in the pipe equals the weight of the atmosphere removed, which in theory is about 32 feet, or in practice a little less.

The hand pump is made in almost an infinite variety of forms and styles. The common suction pump (see Fig. 1) has a pipe whose lower end rests in the water; the pump proper is a barrel A of larger diameter than the water pipe. A piston B with valves CC is reciprocated in this pump barrel A, by moving the pump handle up and down. As the piston moves upward the valves CC are automatically closed, and the valve D opens, when the tendency to create a vacuum below sucks up the water, which may thus be raised to a height not exceeding 32 feet. In other words the upstroke of the piston causes the water below to rise because of the atmospheric pressure. To force water higher than 32 feet with a piston movement, the force-pump is employed. This has a solid piston, moving up and down in a cylinder, but the valves are both in the lower part of the cylinder, as shown in Fig. 2. When the piston is rising, as illustrated, the lower valve A opens and water is drawn into the pump barrel, the valve B being closed. When the piston reaches the top and starts its return downward stroke, the pressure closes the valve A and opens the valve B, and the water in the cylinder or pump barrel is forced into the pipe leading upward which may extend to a considerable height. As described, the action of the force-pump is intermittent, but it may be made to deliver water continuously by attaching an air-chamber to the eduction pipe. The air in this chamber is compressed while the piston is forcing water up the eduction pipe, and on the return movement of the piston, its pressure being removed for an instant, the compressed air acts as a spring and pushes up some water. The force-pump, it is apparent, raises the water as far as the pump barrel on the same principle as the suction pump, atmospheric pressure being the raising force in both cases, but above that point the action of the force-pump is that of the downward force exerted

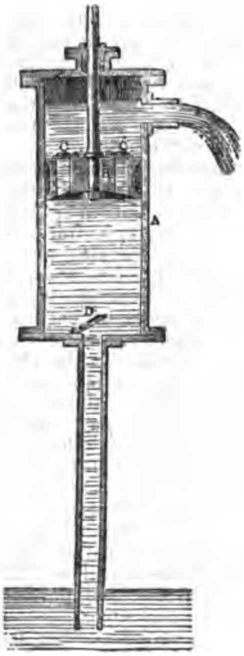

Fig. 1.—Suction Pump.

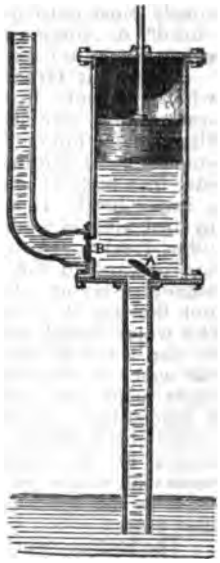

Fig. 2.—Force Pump.

by the pump handle on the confined water in the pump barrel, so that it is free to raise more water on every stroke regardless of its perhaps having already raised a column of water 32 feet up to the barrel.

The force-pump barrel is usually set in a horizontal position, with the pump handle vertical, so that the man pumping can throw his weight against it in much more effective fashion than in an up-and-down stroke.

A lift pump is one that raises the water bodily by lifting or scooping it up; it may employ a piston in a tube, but the common device is an endless chain with circular buckets fixed a few inches apart, these buckets being shaped like washers and fitting loosely the bore of the pipe through which the chain is raised. The chain is hung at the top over a driving windlass; the lower end dips in the water; the turning of the windlass by a crank draws one side of the chain up through the pipe, and the washer-like buckets draw up the water between them. The old-fashioned ship-pump was the simplest sort of lift pump, consisting of a pipe running from the deck nearly to the bottom of the ship's hold. In this pipe was let down a rod, having a handle at the top and dish-shaped leather buckets near the lower end. By working the handle up and down the sailor who manned the pump lifted water in a continuous stream. With such a pump it was necessary for the sailor to make the downward movement rapidly, so as not to lose the water raised, while reaching down for more.

A centrifugal pump of the form also called a rotary pump is one having a short cylindrical case, in which turns a rotary piston having several radial arms that embrace sectors of the cylindrical space, so that water may be admitted at one side and passed out at the other side. Tesla's pump might also be called centrifugal, since it receives the water axially in a wheel, and throws it out at the periphery; its fundamental characteristic, however, is capillary attraction or skin friction. By placing several discs about three-sixteenths of an inch apart and rotating them in unison the water is picked up by the side friction of the discs, and then when the disc spaces are full, it is thrown out by centrifugal force. A centripetal pump is one having a rotating mechanism that picks up the water at the periphery and delivers it at the axis, a sort of reversed turbine.

Steam pumps are made in numerous forms, some being simple force-pumps operated by a steam-engine. A common direct-acting steam pump has large gears mounted in a water-tight case, and meshing closely so that their rotation withdraws the air from a water pipe, creates a partial vacuum and raises the water. The propeller pump, or spiral pump, also called Archimedes pump, employs an inclined tube, within which a broad-bladed screw turns, the edges of the blades filling the tube. When the lower end is placed in water, and the tube placed at an angle of about 30 degrees, rotation of the screw picks up the water by the advancement of the blades and carries it to the top.

The vacuum pump utilizes a closed vessel, to which steam is admitted and a little cold water then turned in to condense the steam. This condensation forms a partial vacuum, and because of atmospheric pressure the water rises and fills the steam chamber. The pulsometer pump is of this type. It consists essentially of a double chamber, having a ball-valve at top and clack-valves at bottom. Steam is admitted to one of the chambers and presses out the water contained there. Condensation then taking place a vacuum is formed, and the ball falls over and closes the opening through which the steam entered and water flows up through the clack-valves and again fills the chamber. The steam in the meantime acts upon the water contained in the adjoining chamber. Condensation then taking place there, the ball falls back to that side, and the operations go on alternately, the result being a steady stream of water sucked into one chamber after another, and then forced out and upward by the steam pressure. The water is drawn into the machine from the centre.

A hydraulic or hydrostatic pump is simply the pump of a hydraulic press, crane, punch, etc. The principle of the hydraulic press and hydraulic ram are described under those titles. The hydraulic crane and hydraulic punch are simply a crane or a punching press having one or more hydraulic cylinders with large diameter pistons which are moved with great force by means of water pumped in through a small aperture. The pressure of water varies with the degree of surface. If a stream of water of one square inch cross section be forced into a large cylinder under a pressure ot 100 pounds, the pressure of the water will move a piston of 500 square inches surface sliding in the large cylinder, with a push of 50,000 pounds, less the friction involved, which is slight. The larger piston of course will move at one five-hundredth of the speed of the smaller pumping piston.

Hydraulic Mining.— This term is applied to that system of mining in which heavy streams of water are played on a bank of earth or gravel to wear it away. The streams are thrown by «giants,» which are simply huge nozzles by which the water is delivered from some high head, giving great pressure. Where plenty of water is to be had there is no such cheap way of opening up a hillside for the miner as the hydraulic system. The giant streams bring down the gravel rapidly and in just the right condition for easy panning of the gold or other valuable metal content. But this system ruins the locality for agricultural purposes, because all the soil is buried beneath deep beds of gravel, and so hydraulic mining is in disfavor with all other interests, and in some States is prohibited by law. The «miner's inch,» originally a measure of water for the placer miner, and now also a unit of measure for water used in irrigation in the arid regions of the West and Southwest, has interest as a hydraulic flow through an orifice and subject to the laws governing such flows. It is adjudged to be that amount of water which will flow through an inch-square opening in an inch board, all the edges being sharp, under a head of six inches (sometimes seven inches) above the upper edge of the opening. The amount of water which actually passes under such conditions is 1.52 cubic feet per minute. It varies, however, in different localities. In Arizona, Idaho, Nevada and Utah the customary miner's inch is a deliverance of 1.2 cubic feet per minute. In California and Montana it is fixed by law at 1.5 cubic feet per minute.

Dams and Canals.— The hydraulic engineer is called upon to design and construct dams under ever varying conditions. Most modern river dams are made of concrete, or part concrete and part stone; the concrete is often reinforced. It is common to curve the dam up stream so as to form an arch, thus greatly increasing the strength of the dam, as its resistance may be considerably more than its weight. The up-stream side of a dam is usually sloped, and if the dam is of rubble or riprap, is faced with timber or concrete; the downstream side of a dam may approach the perpendicular. Every dam requires a waste weir with gates to let out the surplus water in time of flood or emergency. Insufficient dams have occasionally burst, flooding the valley below, as at Johnstown, Pa., but these calamities have served to inform engineers more fully as to conditions, and there is every reason to place confidence in modern dams. See IRRIGATION; WATER SUPPLY.

Canal engineering is a part of hydraulics, and has reached its highest development in the building of the Panama Canal (q.v.). The principle of a canal lock is simple. Where there is a change of level of the water in a canal a lock is formed by building two dams having great gates and located a few hundred feet apart. The space between these dams is termed the lock. When a vessel is to pass, say from the lower to the higher level, the water within the lock is let out by means of small gates until the water of the interior of the lock is at the lowest level, the upper gates of course being kept closed. The large lower gates are then opened wide and the vessel is floated in to the lock; then the lower gates are shut, and small gates in the upper end of the lock are opened, so that water flows in until the lock is filled to the upper level, when the upper large gates are opened, and the vessel floated up and out of the lock. To pass a vessel down through a canal lock the operation described is reversed. Water is lost from the upper level at every such passage, but in designing a canal the engineers find streams to supply water to keep the upper levels full.

Wave Motors.— One of the most interesting fields of hydraulic study is connected with wave motors. In theory the waves on the ocean constitute a tremendous power, which it ought to be easy to harness for man's use; in practice the wave motor has never been able to compete with the steam-engine. The wave motor has been constructed in hundreds of ways, and the files of the Patent Office are flooded with designs, most of them ingenious, and very many of which have been built and tried out; but though the machines develop immense power at times, they accomplish little at low tide and in very calm weather, while in storms they are apt to be broken to pieces by the tremendous exercise of surplus power. It remains for some inventor of the future to make the wave motor commercially practicable.

See CANAL; ENGINEERING, HYDRAULIC; HYDRAULIC RAM; HYDRODYNAMICS; HYDRO-ECONOMICS; HYDRO-ELECTRIC DEVELOPMENT; HYDROSTATICS; HYDROGRAPHY; HYDROLOGY; IRRIGATION; WATER-WORKS, etc.

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HYDRAZINE, or **DIAMIDOGEN**, a substance having the formula N_2H_4 (or $H_2N.NH_2$), obtained (together with oxalic acid, $H_2C_2O_4$,) by heating an aqueous solution of the complicated substance known as triazoacetic acid $(C_3H_3N_6)_3(COOH)_3$. It is a gas with a peculiar penetrating odor, but the properties of the pure substance are imperfectly known, on account of the avidity with which it combines with water to form the hydrate, $N_2H_4H_2O$, and the consequent difficulty of isolating it. Hydrazine hydrate is a powerful base, combining with acids to produce numerous definite crystalline salts. Among these the sulphate, $N_2H_4.H_2SO_4$, and the two hydrochlorides, $N_2H_4.2HCl$ and $N_2H_4.HCl$, are important. The hydrate may be prepared by boiling the sulphate with a solution of caustic soda. It is a fuming liquid, somewhat oily in appearance, and boiling at 245° F. The hydrate reduces cold ammoniacal solutions of silver nitrate and also reduces Fehling's solution. It attacks glass, cork and india rubber, but may be kept in silver vessels.

The substances derived from hydrazine by replacing one or more of its hydrogen atoms by compound radicals are also called «hydrazines.» If only one hydrogen atom is replaced the hydrazine is said to be «primary.» If two hydrogen atoms are replaced, the hydrazine is said to be «secondary.» The radical which replaces the hydrogen may belong to the fatty series, or to the aromatic series. One or more of the hydrogen atoms may also be replaced by a metal, such as sodium. The most important of the organic hydrazines is phenylhydrazine, in which one of the hydrogen atoms is replaced by the aromatic radical phenyl, C_6H_5. This substance, which has the formula $(C_6H_5)HN.NH_2$, is a colorless, oily liquid, which solidifies a mass of tabular monoclinic crystals on cooling to 73° F. It mixes with alcohol, ether, benzene and chloroform, but hardly at all with water. It reduces Fehling's solution in the cold, and is very poisonous. A secondary hydrazine is «symmetrical» when the two substituted radicals are attached to different nitrogen atoms; it is «unsymmetrical» if they are attached to the same nitrogen atom. Thus $(C_6H_5)HN.NH(C_2H_5)$ is the symmetrical secondary hydrazine of phenyl (C_6H_5) and ethyl (C_2H_5), while $(C_6H_5)(C_2H_5)N.NH_2$ is the unsymmetrical secondary hydrazine of the same radicals.

HYDRAZONES. See COAL-TAR COLORS.

HYDRIÆ. See VASES.

HYDRIDE, a chemical substance formed when hydrogen combines with a metal, or some simple or compound metallic base, or with a compound radical acting as a base. Formerly the term had the same meaning as hydrate, and this must be borne in mind when studying the older works on chemistry.

HYDRIODIC ACID, or **HYDROGEN IODIDE** is an acid composed of hydrogen in combination with iodine, and having the formula HI. Hydriodic acid is analogous to the more familiar hydrochloric acid, both in its chemical structure and in its general properties. It may be prepared by the direct union of hydrogen and iodine at a red heat. A more convenient method, however, consists in passing sulphuretted hydrogen gas (H_2S) into water in which a little pulverized iodine is suspended. The reaction is $H_2S + 2I = 2HI + S$. The action is slow owing to the deposition of sulphur which encases the iodine particles and prevents their free solution. The larger the amount of hydriodic acid formed, the faster the operation progresses. Fresh supplies of iodine are added from time to time, and the liberated sulphur is finally removed by agitation and filtration, the sulphuretted hydrogen remaining in solution being also removed by the application of gentle heat. In another method the iodine is dissolved in carbon bisulphide, and the solution covered with a stratum of water. When sulphuretted hydrogen is passed into this mixture, the hydriodic acid as it forms is dissolved in the water, and the sulphur set free is dissolved in the carbon bisulphide. The aqueous solution is boiled to expel the sulphuretted hydrogen it may have taken up and the hydriodic acid remains in a pure state in the solution. The aqueous solution so prepared possesses strongly acid properties, and combines with bases to form salts called iodides. The pure acid is a colorless gas, with an odor similar to that of hydrochloric acid gas. It has a density about 63 times as great as that of hydrogen, and at a temperature of 32° F. it condenses to a liquid when subjected to a pressure of four atmospheres; the liquid so obtained freezing to a solid mass at about 67° F. below zero. The specific heat of the gas, at ordinary temperatures, is about 0.055 (at constant pressure), and the ratio of its specific heat at constant pressure to its specific heat at constant volume is 1.397. It dissolves freely in water, the specific gravity of a saturated aqueous solution, at 32° F., being about 2.00. The aqueous solution is colorless when pure, but it is slowly decomposed by sunlight, becoming dark from the liberation of iodine. It is also decomposed by sulphuric and nitric acids and by chlorine and bromine, which set the iodine free. In medicine hydriodic acid is administered as a syrup.

HYDRIODIC ETHER (more correctly known as ethyliodide), a heavy, colorless liquid with a sharp, pungent taste and a penetrating ethereal odor, obtained by acting upon pure ethyl alcohol (C_2H_5OH) by iodine, in presence of red phosphorus. The proportion is 1 part of red phosphorus (or equal parts of red and yellow phosphorus), 5 parts of alcohol and 10 parts of iodine added slowly. After 24 hours the hydriodic ether is distilled off, and washed with a solution of sodium hydrate and water, and dried over calcium chloride. In large quantities it is prepared by adding sulphuric ether slowly to a warm, concentrated aqueous solution of potassium iodide, or by the action of hydriodic acid upon sulphuric ether. Hydriodic ether has the formula C_2H_5I, boils at 162° F. (under ordinary atmospheric pressure), and has a specific gravity of about 1.946. When not quite pure it becomes brownish upon exposure to light, from the liberation of iodine. In chemistry, hydriodic ether (or ethyl iodide) is largely used as a fundamental substance in the preparation of the various other compounds of ethyl.

HYDRO-ECONOMICS. The science that investigates the conditions and laws affecting the occurrence and use of water as a material means of satisfying human needs and desires, and that takes into consideration also the proper balance between cost and benefits to be derived in each particular case from the practical application of these laws. Water for drinking purposes next to air is the most important substance necessary for the support of life. It must be had at short intervals in suitable quantities and qualities for the daily needs of mankind and for all animals and plants; thus to the extent to which these are used as a food, it is vital also in food production. The regulation of its supply for watering live stock and for irrigation in producing crops is an essential for the welfare and the increase of population. As a correlative, the reduction of excess of water by drainage is equally important. Related to these is the conveyance away from human habitations and centres of population of waste products through sewage systems and the economic disposal of manufacturing effluents or waste in running water, where this can be properly done.

The data for the study of hydro-economics necessarily fall into several groups of subjects, primarily those relating to the properties — physical and chemical — of water as a substance, next to its occurrence in nature, these facts being included within the science of meteorology. Following these are the measurements of its volume included within hydrology and the mapping of large bodies of waters, rivers, lakes and oceans, known as hydrography. All of these data are needed in the consideration of the largest development and use of water for human needs, *first,* as above stated in the direct support of life involving questions of domestic and municipal supply; *second,* in the production of food directly through water needed for domestic animals and for the irrigation of crops or the relief of the excess from the tilled fields by means of drainage; *third,* in relative importance come questions of conveyance of waste from towns and factories; *fourth,* the employment of water in the industries in the production of power directly by water wheels, included in the science of hydraulics, or in steam production, this being within the range of thermo-dynamics. The *fifth* use of water is that of transportation of persons and goods, included under the head of navigation. This latter use, under modern conditions and due largely to the rapid development of railroads, has declined in relative importance. From the standpoint of Federal law, however, navigation has priority over other uses, the Constitution of the United States providing, in Section 8, that Congress shall have the power "to regulate commerce with foreign nations, and among the several States, and with the Indian tribes."

Under a very broad interpretation of this provision, Congress has undertaken the regulation not only of the interstate but of many intrastate streams and has authorized the building of extensive levees and related works for the protection of agricultural lands from overflow. It has also made appropriations for the purchase and protection of forests at the headwaters of streams whose lower reaches may be navigated — the tendency being to enter upon the development and use of the water resources of the country under Federal auspices as far as practicable under a liberal interpretation of Federal power conferred by this clause of the Constitution.

As proprietor or guardian of the vast area of public lands in the western part of the United States, Congress has made appropriation of the funds resulting from the disposal of portions of these lands to be used in the storage and distribution of water occurring in the arid and semi-arid States and under the terms of the Newlands or Reclamation Act, 17 June 1902, has provided for the irrigation of extensive tracts, the Reclamation Service being created for this purpose. It has expended over $100,000,000 in building large works such as the Roosevelt Dam in Arizona, the Arrowrock Dam, 350 feet high, the highest in the world, in Idaho, and other great structures, including tunnels, canals and subsidiary works, such as roads, railroads, electric transmission lines and minor manufacturing plants, all for the purpose directly or indirectly of conserving and utilizing the natural resources of the country.

The science of hydro-economics may thus be said to bring together for practical application many of the subjects which form portions of physics, chemistry, meteorology, hydrology, hydrography and hydraulics and to combine these in the building of waterworks, sewers and disposal works for towns and cities. Also for irrigation and drainage systems, for power plants — electrical or otherwise, — for steam production, for flood prevention, by forest growth, reservoirs or other means, also for flood protection by levees or dikes, and finally for navigation including the character and size of channels and related details, boats, barges and terminal facilities. The constitutional and legal phases introduced by Federal, State or municipal laws and the interpretation by the courts of the common law regarding riparian rights as well as statutory enactment have a part.

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HYDRO-ELECTRIC DEVELOPMENT, the term by which the engineering profession has come to designate the production of water power and its electrical distribution for use as power, light and heat. About 1890 it was recognized by some that a change in motive power was imminent, and that gradually the steam-engine and boiler depending on coal would be replaced by water wheels, utilizing the largely wasted forces of the rivers, streams and waterfalls, and converting these into electricity, to be sent out at high pressure, over hundreds of miles of wires, and thus distributed to lighting plants and electric motors for use where needed. Gradually capital was interested, and power sites have been acquired, and now there has come to be competition for the remaining good water powers, and the public has even been alarmed at the suggestion of monopoly of the important natural resource represented by the potential power of its flowing waters.

The Niagara Falls power plants settled the question of economical utilization of water power on a large scale. The latent power of the great waterfall was utilized in 1877 in a small way, and in 1886 the Niagara Falls Power Company was chartered to utilize the power on a large scale. It took them 10 years to get going, and the leading engineers of the world were consulted as to the best mechanical means of using the tremendous head and mighty volume of descending water. The difficulty of the problem lay in the fact that there was so much power that ordinary machinery was likely to be broken up by the mighty force it was desired to harness. But the cataract yielded to man's genius just as has the harnessed lightning. A side channel was dug by the Falls, and a pit sunk so as to allow of using a head of 136 feet, and at the foot of these were placed turbines, with shafts running up to the top of the pit, and directly connected to dynamos, each of 5,000 horse power, far the largest that had then been constructed. To support the weight of this great 136-foot steel shaft, carrying the heavy dynamo and turbine, and whirl it around at a peripheral speed far exceeding that of the fastest railway train, without wearing itself out with friction was indeed a problem. No known bearing would stand such tremendous friction, therefore a new form of bearing had to be devised; and the form decided on was highly admirable. As constructed the heavy column and revolving machinery rest on the flowing water itself. The water comes down the interior of the columnar pipe, strikes the lower surface, rebounds or reacts against the blades of the turbine, causing it to rotate and at the same time lifting or supporting it in an almost frictionless manner. Thus was solved the problem of using the turbine wheel for comparatively high heads of water to gain very large power for a single unit machine.

One other important invention was needed to make the utilization of great water power complete, and that was means for sending out a great voltage of electricity to a long distance. This was accomplished by Nikola Tesla, in his notable discovery of the rotating magnetic field. He reversed the arrangement of the dynamo as constructed before his time, making the core stationary, and arranging the magnetic field to revolve around it. This made possible a dynamo for high service, and with the development of improved methods of insulation and minor details, the mechanism for long-distance power, light and heat transportation was complete.

It is true that before 1891 two fair-sized hydro-electric plants had been established, one sending electricity 13 miles from Oregon City to Portland, Ore., and the other 29 miles from Pomona to San Bernardino, Cal., but these were single phase currents, of not more than 10,000 voltage, adapted to running street cars and electric lights, but not for miscellaneous purposes, for which a polyphase current is requisite. It should be understood that an alternating current generator can be constructed to generate two or more currents alternating at the same rate but not at the same time. One current will be just stopping and changing its direction when the other current is flowing with full force; the next instant the first current will come up to its full strength, and the second current will stop and reverse. Three as well as two alternating currents can be combined and transmitted in this way to a distance, and this system is called three-phase or polyphase transmission. A polyphase current applied to an alternating current motor produces a balanced rotation of the armature very much as three or more cranks on an engine-shaft balance each other. One current in the motor will be doing its maximum work while another is at or approaching zero, just as in the engine one crank is exerting its maximum push as another is at or approaching its dead centre. Three-phase transmission was first successfully accomplished in 1891 at Frankfort, Germany, and is now universal.

The transformer is an important adjunct in an electrical transmission system. It is based on the principle of the induction coil (q.v.). The essential parts are a core of laminated sheet iron wound with two coils of copper wire, one coil consisting of numerous turns of fine wire and the other coil of a few turns of coarse wire. If the fine wire coil is connected to the line a much lower pressure current can be drawn from the coarse wire or secondary coil; if the connections are reversed and the fine wire coil is used for a secondary, a current of much increased pressure is generated. Thus the transformer is used, as its name implies, to «step up» or «step down» the pressure. The relative number of turns in the primary and secondary coils determines the ratio of the steps obtained.

To distribute hydro-electric power economically, it has been found best to first create a very high potential for the alternating current, and to send this out to a station, where there are transformers, and it can be stepped down for use, and by means of rotary converters can be changed into direct current when desired. It is not many years since it was considered an achievement to send out 40,000 volts on a wire, but now 150,000 voltage is used, and still higher pressures are contemplated.

To develop the water power, a stream has to be dammed, a reservoir formed to maintain a flow of water and a power-house with water wheels must be installed. The head or fall of water determines the sort of water wheel to be employed. All heads under 300 feet are now classed as low heads, and all over about 700 as high heads; the wheel accepted for low heads is the turbine, and for high heads the impulse or Pelton wheel. For intermediate heights of head, conditions have to determine which form of wheel is best. For a fuller description of water wheels see HYDRAULICS.

Water-power plants are usually supplied with two sorts of dams, storage reservoirs and diverting dams. These are now mostly constructed of masonry and concrete. Conduits for conveying the water are made of both wood and steel; the wood may be rectangular or box-shaped, or of circular cross-section, made like a continuous barrel with staves and steel bands. These wood stave pipes are exceedingly strong, and will carry a 200 foot head, and last for years. But for greater pressure and durability steel pipe is requisite. Lap-welded galvanized sheet steel is the favorite material, and it is made of a tensile strength of 50,000 to 65,000 pounds per square inch of section. It is lapped and triple-riveted for carrying heavy pressures. Such steel pipes are often three to five feet in diameter, and have been made up to seven feet. When of considerable length the construction has to allow for contraction and expansion of the metal with changes in temperature. One engineer reported that a long section of metal pipe «crawled»— that is, expanded and moved its position lengthwise— seven inches between the extremes of heat and cold of a single 24 hours.

Where the water is not under pressure, as in a tail-race, it may be carried in an open channel, and such are frequently built of concrete. It is often necessary to tunnel through the rock to find a proper outlet. To use a high head of water a power station must occupy a low site, which means standing in a valley. After using the water here the next problem is to get rid of it, which means leading it to some lower locality where it can flow away. To find such lower level it is sometimes necessary to tunnel for miles.

Complete statistics of the extent of hydro-electric power development are lacking. The United States census of 1910, covering returns made by manufacturing establishments in 1909, shows only a very small percentage of water power in use, and it is known to be far larger than the official figures show. To illustrate: In 1869 the census reported a total of 2,346,000 horse power used in manufacturing, of which 1,130,000 or nearly a half was water power. In 1889 the total power recorded as used in manufacturing was only 10,000,000 horse power, of which 1,454,000, or 14.4 per cent, was water power, and nearly all the rest steam power. This was the date at which hydro-electric development really began, yet 20 years later, in 1909, in spite of the tremendous development of plants, as recorded farther on, the increase of water power is given at only a little more than 1 per cent a year. The steam power is credited in 1909 with 14,199,000 horse power, electric power is credited with 1,749,000 horse power and the water wheels get credit for only 1,823,000, or less than 10 per cent of the total. This despite the known development of tremendous horse power at Niagara, Big Creek, Tallulah River, Las Plumas, Butte, Keokuk, etc. It is true than the census figures quoted do not include the use for mines and quarries, which is reported separately at the insignificant figure of 97,460 water power, as against 255,699 electric and 4,608,000 steam horse power. This 1909 census does credit New England with 27.9 per cent of her horse power as being derived from water, but only allows 5 to 8 per cent for far Western States.

It would appear that the reason why the census does not show the extent of the hydro-electric development is that the method of gathering returns from manufacturers did not cover the situation. Probably a very large part of the power credited as electric is hydro-electric, and another large part escapes enumeration under the head of manufacturing or mining, because it is utilized by street railways and lighting companies whose reports do not always indicate the source of their supply. Hence the census figure of 1,823,000 total water power used in manufacturing in 1909 probably represents less than half of the total use, and at the present time it is a fair estimate that the total hydro-electric horse power in use in the United States for all purposes is 5,000,000 and the capacity of these plants is fully 9,000,000 horse power.

A description of a few of the hydro-electric power and transmission plants will afford some idea of the actual accomplishments in this field. The Pacific Light and Power Company of Big Creek, Cal., has utilized a small stream for a phenomenal power development. The creek drops 4,000 feet in six miles and by two installations the engineers utilized 3,680 feet of this head. The equipment includes three large concrete storage reservoirs that will hold 4,500,000,000 cubic feet of water. From these the water flows first through a 10,360 foot tunnel, and 425 feet of standpipe, arriving at Power Station No. 1 with 1,900 feet effective head. Here are installed two 17,500 k-v-a generators and four 10,000 horse power Pelton water-wheels, each of one nozzle. The tail water from this plant runs off through another long tunnel and pipe, and delivers at Power Station No. 2, with 1,780 feet effective head. Here there is another installation of a total of 35,000 k-v-a generators and 40,000 horse power water-wheels. These two stations have an ultimate capacity of double the power they are now supplying. The dynamos send out the power over a line of 240 miles, made of steel aluminum wires, carried on steel towers, at the enormous pressure of 150,000 volts.

The Pacific Gas and Electric Company, with headquarters at Denver, Cal., have 150 miles of transmission line operated at 110,000 volts, 380 miles at 20,000 volts and many miles of minor lines at 11,000 volts. In 1913 they were equipped with generators for 25,000 kilowatts, but a capacity of 50,000. They use 12,500 k-v-a generators, each driven by two 8,500 horse power Pelton wheels of single nozzle type. They now have in all 11 hydro-electric stations, and their highest head is 1,345 feet. The Sierra and Santa Fe Power Company, at Stanislaus, Cal., in 1907–08 built a plant which is running at 34,000 kilowatts, the capacity may be increased any time to 75,000 kilowatts, which is the equivalent of about 100,000 horse power. The plant includes four 8,500-kilowatt generators, and eight 6,000 horse-power single-nozzle Pelton wheels.

The Tallulah River plant of the Georgia Railway and Power Company, which supplies Atlanta and vicinity, is one of the most notable in the South. The electric current is sent 90 miles to Atlanta and 50 and 80 miles in other directions, at as high as 110,000 volts. The storage reservoir has a billion and a quarter feet capacity, and there is a large diversion dam. A tunnel of 6,670 feet carries the water to the six penstocks, each of which serves a 10,000-kilowatt Francis turbine of 514 revolutions per minute. A large medium-head plant is that of the Great Western Power Company at Las Plumas, Cal., which was completed about 1910, and supplied with five 10,000-kilowatt generators, each driven by 18,000 horse-power, vertical shaft, single-runner turbines. The head here is 465 feet, and the water is carried 15,168 feet through a pressure tunnel. An illustration of large power obtained from a low head is seen in the plant of the Mississippi Power Company, at Keokuk, Iowa, which sells power in Saint Louis at the low rate of $18 per horse power. In 1913 the plant was developed for 112,500 kilowatts, but there is an ultimate capacity of 225,000 kilowatts. They use 7,500-kilowatt generators and 10,000 horse-power Francis turbines, employing 32 feet head. The Alabama Power Company's installation at Coosa Lock, in 1914 totaled 52,000 kilowatts, with 78,000 ultimately available. They use 17,500 horse power single-runner turbines, direct-connected to 13,500 k-v-a generators, and have 68 feet head of water. The No. 3 plant of the Niagara Falls Hydraulic Power and Manufacturing Company uses generators to a total of 130,000 k-v-a, and has 13 10,000 horse-power turbines running under 210 feet head. The power projects now under way at Niagara indicate an increased development on the American side of at least 600,000 horse power, and as much on the Canadian side.

The great trunk line railways of the country are most of them planning for a greater or less electrification of their lines, and naturally will avail themselves of water powers along their routes wherever they can be used economically. Much of the water that is dammed for irrigation or transported for city supply can be used en route for supplying power without loss, and this is already being done, and is sure to become a common practice.

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HYDRO-THERMAL METAMORPHISM. See METAMORPHISM.

HYDROBROMIC ACID, or **HYDROGEN BROMIDE,** a compound having the formula HBr, and analogous in its general properties to hydrochloric and hydriodic acids. Hydrogen and bromine do not combine directly, even in strong sunlight; but when hydrogen that is charged with bromine vapor is burned, hydrobromic acid and water are formed. Hydrogen and bromine may also be made to combine by electric sparks, or by passing the mixed gases through a hot tube, or over hot platinum. The most convenient way of preparing the acid, however, is by the action of bromine upon water, in the presence of phosphorus, the reaction being $4H_2O + 5Br + P = 5HBr + H_3PO_4$. Phosphoric acid, it will be seen, is formed at the same time; but the two are easily separated by heat. Pure hydrobromic acid, when free from water, is a colorless gas of pungent odor, having a density about 39.1 times as great as that of hydrogen. Under ordinary atmospheric pressure it condenses into a liquid at 99° below zero F., and at a slightly lower temperature it crystallizes. It dissolves freely in water, a saturated solution, at 32° F., having a specific gravity of 1.78, and containing 82 per cent of hydrobromic acid, by weight. A concentrated aqueous solution of hydrobromic acid fumes strongly in the air, but does not decompose.

When heated, the gaseous fumes are evolved until the solution contains about 47 per cent of the acid, when it boils continuously at 126°. Hydrobromic acid is a powerful acid, forming, with metallic bases and with organic radicals, definite salts called «bromides.» Hydrobromic acid is used in medicine in the treatment of the ear, and the bromides of the alkalis are extensively used as sedatives. Bromide of silver is also used in large quantities in photography, in the manufacture of sensitive dry-plates.

HYDROCARBON GASES. See LIQUEFIED AND COMPRESSED GASES.

HYDROCARBONS, the simplest of organic compounds, consisting solely of carbon and hydrogen. They are exceedingly numerous, and many of them occur in nature, both in petroleum, asphaltum and similar minerals of organic origin, and in the essential oils of plants. They are produced economically in the dry distillation of wood and peat, and are components of illuminating gas and the oils of coal tar. The hydrocarbons can be broadly divided into two general classes: (1) saturated hydrocarbons; (2) unsaturated hydrocarbons; — according to the way in which the carbon atoms that they contain are connected to one another. The first class contains only the single-linked carbon atoms; the second class comprises those in which pairs of carbon atoms are united in doubles or threes. The first class includes only the paraffines.

In the fatty series, the atoms are all connected in open chains, while in the aromatic series the carbon atoms are connected with one another in such a manner as to form closed rings. (See FATTY COMPOUNDS and AROMATIC COMPOUNDS). As a class, the hydrocarbons are insoluble in water; they cannot be saponified; and they are neutral, and do not combine with acids to form salts.

The classification of the hydrocarbons is as yet incomplete; but the greater number of those that are known can be included in one or another of the following groups:

1. The *Paraffins,* having the general formula $C_n H_{2n+2}$. The lowest member of this series is methane, or marsh gas, CH_4, and many other members of the series are known, each containing one carbon atom and two hydrogen atoms more than its immediate predecessor. See PARAFFINS.

2. The *Olefines,* also known as Alkylenes, or Alkenes, having the general formula $C_n H_{2n}$. Ethylene, C_2H_4, is the simplest member of this series, which includes also propylene; the butylenes; amylenes; hexylenes; heptylenes, etc.

3. The *Acetylenes,* or Alkines, and the *Allylenes* or Diolefines, having the general formula C_nH_{2n-2}. Acetylene gas, C_2H_2 is the simplest representative of this series, which includes also allene; divinyl, erythrene or pyrrolylene; piperylene; isoprene, diallyl, conylene, etc.

The foregoing all belong to the fatty subdivision. At a red heat three molecules of acetylene unite to form one molecule of benzene, thus linking the aliphatic or fatty series with the aromatic series. The latter class embraces:

4. The *Benzene* series, having the general formula C_nH_{2n-6}, known also as the cyclic hydrocarbons, and the terpenes.

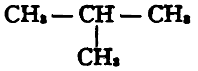
5. The *Terpenes,* or alicyclic compounds, a class of substances having the general formula $C_{10}H_{16}$, and including pinene, camphene, fenchene, sylvestrene, carvestrene, terpinolene, terpinene, etc.

The known hydrocarbons having any one general formula may be ranged in a series, whose members exhibit a sort of regular progression in their properties. For example, the first eight members of the normal paraffin group may be arranged as follows:

		Boiling Point.
Methane	CH_4	(Gaseous)
Ethane	C_2H_6	"
Propane	C_3H_8	"
Butane	C_4H_{10}	34° F.
Pentane	C_5H_{12}	100° F.
Hexane	C_7H_{16}	160° F.
Heptane	C_6H_{14}	209° F.
Octane	C_8H_{18}	258° F.

A series of this sort is said to be «homologous.»

The paraffins are said to be «normal» when they contain but two methyl groups (CH_3). Thus normal propane, C_3H_8, has the constitutional formula $CH_3.CH_2.CH_3$; and it is not possible to arrange its atoms in any other way. In proceeding from this hydrocarbon to the next in the same series (that is, butane, C_4H_{10},) we may substitute the methyl group, CH_3, for a hydrogen atom in the CH_2 of the propane, or for a hydrogen atom in one of the CH_3 groups. Hence we may have either of the two following constitutional formulas for the hydrocarbon butane:



$$\begin{array}{c} CH_3 - CH - CH_3 \\ | \\ CH_3 \end{array}$$

or

$$CH_3 - CH_2 - CH_2 - CH_3.$$

The latter compound, which contains only two CH_3 groups, is called «normal butane»; while the former, which contains three such groups, is known as «isobutane.» Two butanes, each having the empirical formula C_4H_{10}, are therefore possible, and both are actually known. When we pass to the higher members of the paraffin group we find that a far greater number of isomeric forms can exist, according to the way in which the new CH_2 group is introduced, in generating the new hydrocarbon from the one next below it in the general series. Thus octane, C_8H_{18}, can exist in 18 different isomeric forms, and tridecane, $C_{13}H_{28}$, in no less than 802.

The saturated hydrocarbons are of the greatest value in the arts, comprising a series of solvents (as naphtha, benzol, etc.) for fats, oils and resins, the mineral oils used for lighting and lubrication, motor fuels, vaseline, paraffin wax, the essential oils from which are derived perfumes and flavorings, the camphors, etc. Consult Norris, J. F., 'Principles of Organic Chemistry' (New York 1912); Plimmer, R. H. A., 'Practical Organic and Bio-Chemistry' (London 1915); Pond, F. J., 'Heusler's Chemistry of the Terpenes' (Philadelphia 1902); Spielmann, P. E., 'Richter's Organic Chemistry' (Vol. I, London 1915).

HYDROCELE, hī'drō-sēl, a collection of serous fluid forming tumors around the testicle or spermatic cord. During the fœtal life the testicle pushes the peritoneum before it as it descends from the abdomen into the scrotum. Along the spermatic cord the sac is usually obliterated, but if it is not it may become distended with fluid. The pouch of the peritoneum normally remains alongside of the testicle, and is called the tunica vaginalis. Distentions of these pouches may be congenital, but ordinarily they begin after maturity and probably are due to some fault in the blood-vessels, allowing the escape of the serum. Symptoms are due to the weight of the tumor, and the only danger lies in the possibility of the injury and rupture of the sac. Aspiration of the fluid, followed by the injection of a few drops of carbolic acid, may accomplish a cure, but partial removal of the sac may be necessary.

HYDROCEPHALUS, a dropsical effusion of fluids into the interior of the skull, occupying one or more of the ventricles of the brain or the submeningeal space, or both. The symptoms of acute meningitis are such that the older authors called this disease acute hydrocephalus, but there may be very little fluid exudation in meningitis, and when present it is not often clear and watery. The causes of chronic hydrocephalus are various. A low-grade inflammation may give rise to chronic hydrocephalus, just as chronic peritonitis is accompanied by fluid in the belly, but the usual cause of chronic hydrocephalus is some obstruction to the venous circulation. It is regarded as certain that arrest of development of the brain-substance, pressure upon the veins of Galen by masses of tubercle or cancer, and in fact any condition which obstructs the venous circulation in the brain, may lead to hydrocephalic effusion, just as pressure on the veins of the leg may produce dropsy of the feet. It is probable also that in arrest of brain development the increase of the normal subarachnoid fluid is a conservative process, serving to keep full the space between the brain and the cranium. The large majority of cases are congenital, and hydrocephalus must be set down as a disease (or symptom) belonging to infantile life; but cases occasionally occur in mature life or in old age. Dean Swift, after three years of illness, died with hydrocephalus, the result, doubtless, of organic brain disease. The prognosis of chronic hydrocephalus is very grave. The child may live for many years, but, with rare exceptions, becomes idiotic, and in some cases is epileptic. The head becomes distended, the fontanels remain open, supernumary bones form in the courses of the cranial sutures, and in some cases quarts of fluid are effused, consisting of water, with earthy salts and a little albumin; while in acute hydrocephalus there is sometimes much albumin present, with some pus-corpuscles or a little blood. When the disease is detected early, mercurial inunctions, with the administration of the iodides, may possibly afford benefit. Treatment by systematic compression or by tapping the skull has been tried in many cases, but the most common result has been the speedy death of the patient, although in a few instances it would appear that more or less advantage has been obtained by these means. The term spurious hydrocephalus is sometimes applied to cholera infantum, infantile typhoid or other enteric disease, the general symptoms of which may simulate those of acute meningitis.

HYDROCHARIDEÆ, hī-drō-ka̤-rid'ē-æ, monocotyledonous floating or submerged aquatic plants of the series Helobieæ. About 50 widely distributed species are known, divided into 15 genera; 12 fresh water, occurring in temperate zones, and three marine occurring in tropical or sub-tropical zones. Vallisneria (q.v.), or eel-grass, and Elodea canadensis, or water-thyme, are well-known American types; Hydrocharis Morsusranæ, or frog-bit, and Stratiotes aloïdes, or water-soldier, are well-known European types. The tropical marine types are Thalassia, Enhalus and Halophila, submerged plants found chiefly in the Pacific and Indian oceans.

HYDROCHLORIC ACID, or **HYDROGEN CHLORIDE**, an important compound of hydrogen and chlorine, which under the names «spirit of salt» and «muriatic acid,» has been known in aqueous solution from very early times. It has the chemical formula HCl, and may be formed by exposing a mixture of equal volumes of hydrogen and chlorine to diffuse daylight, the combination taking place quietly under these circumstances, but explosively under the influence of direct sunlight. A more convenient and usual method of preparing hydrochloric acid is by treating common salt («sodium chloride,» $NaCl$) with strong sulphuric acid (H_2SO_4). The reaction is as follows: $NaCl + H_2SO_4 = HNaSO_4 + HCl$. Pure hydrochloric acid is a colorless gas, 1,259 times as heavy as an equal volume of air at the same temperature and pressure, and with the molecular weight 36.457. By weight hydrochloric acid consists of 2.74 per cent of hydrogen and 97.26 per cent of chlorine. At a temperature of 50° F. it condenses, under a pressure of 40 atmospheres, to a colorless liquid, which boils, under ordinary atmospheric pressure, at 171° F. below zero, and solidifies at a temperature about 6° below the boiling point. The specific heat of the gas at constant pressure (compared with water) is about 0.19; and the ratio of its specific heat at constant pressure to its specific heat at constant volume, at ordinary temperatures, is 1.389. Hydrochloric acid gas was first prepared, in an approximately pure state, by Priestley, in 1774; but it was believed to be an oxide of a new element (provisionally called «murium») until Davy, in 1810, showed that it is a compound of hydrogen and chlorine.

Hydrochloric acid gas is exceedingly soluble in water. If a dry glass flask, which is completely filled with the dry gaseous acid, be brought mouth downward under water, and the stopper is then removed, solution takes place with such extreme rapidity that the water is often drawn into the flask suddenly enough to break it. By passing a stream of the gaseous acid into water, an aqueous solution may be prepared which has a specific gravity, when saturated, of 1.2257 at 32° F., and contains 45 per cent by weight of the acid. The commercial acid is commonly known, to the present day, as «muriatic acid.» Large quantities of it are obtained as a by-product in the manufacture of sodium carbonate by the action of sulphuric acid upon common salt. The hydrochloric acid gas liberated in this process is passed up through stone towers packed with hard coke over which trickles water, which greedily absorbs the gas. The acid solution which collects at the bottom of the tower, if too weak for concentration, is taken to the top and again allowed to seep down and gather a larger content of gas. The acid thus obtained is not pure but contains sulphuric acid, ferric chloride, arsenic and free chlorine and sulphurous acid gases. These impurities give it a yellowish tinge. The pure acid (in aqueous solution) is obtained by removing the arsenic with stannous chloride and then distilling; or by digesting the diluted acid solution with bright copper strips and distilling with ferrous chloride. Aqueous hydrochloric acid is largely used in the laboratory and also in the arts, in the manufacture of a great variety of substances.

Hydrochloric acid combines with metallic bases to form salts which are known as «chlorides.» Common salt (chloride of sodium, $NaCl$) is the most familiar and the most abundant example, in nature, of this class of substances. The chlorides of silver, gold, mercury, barium, aluminum, platinum and ammonia are also important and are described under MERCURY, ALUMINUM, etc. The largest use of hydrochloric acid is in the manufacture of chlorine (q.v.) and chlorides of the metals. It is also used extensively in the arts, as well as in the manufacture of agricultural fertilizers, coal tar colors, etc.

HYDROCYANIC ACID, or PRUSSIC ACID, an exceedingly poisonous substance, discovered by Scheele in 1782. It has the chemical formula HCN, and may be formed by passing a series of electric sparks through a mixture of nitrogen and acetylene (q.v.). The reaction in this case is $2N + C_2H_2 = 2HCN$. The pure acid is more conveniently prepared by passing sulphuretted hydrogen gas, H_2S, over dry mercuric cyanide, $Hg(CN)_2$, hydrocyanic acid and mercuric sulphide being formed, according to the equation $Hg(CN)_2 + H_2S = 2HCN + HgS$. As thus prepared, hydrocyanic acid is a volatile liquid, boiling at 80° F. and freezing at 5° F., and possessing a peculiar smell of bitter almonds. It is inflammable, producing by its combustion carbon dioxide. It is so intensely poisonous that a single drop of the anhydrous acid produces instant death when swallowed, and its vapor, even when mixed with considerable quantities of air, is also exceedingly poisonous. It mixes readily with water, ether and alcohol. Although it is called an acid, and forms salts that are known as «cyanides,» it is very weak in its acid properties. It does not redden litmus paper, and its salts are readily decomposed by other acids. Hydrocyanic acid is formo-nitrile, and like the nitriles is hydrolysed rapidly by boiling alkalis and slowly by mineral acids. In the presence of oxygen the cyanides dissolve all metals but lead and platinum.

Hydrocyanic acid is found in nature in the glucosides of plants, typically in amygdalin, the glucoside of bitter almonds, to which it gives its characteristic odor and taste. In dhurrin, the glucoside of sorghum, it is so plentiful that cattle have been poisoned by eating the green plant too freely. The method usually employed in the manufacture of hydrocyanic acid is to run a solution of sodium cyanide in about twice its weight of water slowly into a small excess of cold 60 per cent sulphuric acid. The resulting vapor of hydrocyanic acid is almost anhydrous, and it is completely dried over calcium chloride. It is kept at a temperature of 85° F., and finally condensed to liquid form in an ice-cooled receiver. Hydrocyanic acid may be synthesized by passing dry ammonia over wood charcoal heated to 1,300° to 1,800°. At 2,000° it is liable to a reverse action, the forming hydrocyanic acid being decomposed as it forms.

Among the more important compounds of hydrocyanic acid are potassium cyanide and mercuric cyanide. Potassium cyanide, KCN, may be formed by passing nitrogen gas over a white-hot mixture of charcoal and potassium carbonate, the reaction being:

$$K_2CO_3 + 2N + 4C = 2KCN + 3CO.$$

It is more conveniently prepared, however, by strongly heating potassium ferrocyanide (see below), which breaks up into potassium cyanide, carbide of iron and free nitrogen. Potassium cyanide is a white salt, soluble in water and in alcohol and exceedingly poisonous. It is much used in electroplating as a solvent for gold and silver, and also in the extraction of gold from certain ores by the process known as «cyaniding.» It melts without decomposition, and in the molten state it is a powerful reducing agent. For this reason it is often used as a flux in welding and in other metallurgical operations. It is used in solution to dissolve unaffected silver salts in the tintype process in photography.

Mercuric cyanide, which is also very poisonous, is used in medicine, and is prepared by dissolving mercuric oxide in an aqueous solution of hydrocyanic acid.

Allied to hydrocyanic acid are two other acids, known respectively as «ferrocyanic acid,» $H_8Fe_2(C_2N_2)_6$, and «ferricyanic acid,» $H_6F_2(C_2N_2)_6$, which are not of any importance in the arts in the free state, but whose potassium salts are much used. Potassium ferrocyanide, or yellow prussiate of potash, $K_8Fe_2(C_2N_2)_6 + 6H_2O$, is prepared on a large scale by heating a mixture of nitrogenous organic matter and caustic potash, and treating the mass with freshly prepared ferrous carbonate. Crude cyanide of potassium is formed in the first instance, and this combines with the ferrous carbonate to form the yellow prussiate of potash and potassium carbonate, from which the yellow prussiate may be obtained in large crystals, by evaporation. When pure, the yellow prussiate is not poisonous. It is used, in the arts, as a source of Prussian blue, and also for the manufacture of potassium cyanide, which is liberated when the yellow prussiate is strongly heated.

Potassium ferricyanide, or red prussiate of potash, $K_6Fe_2(C_2N_2)_6$, is prepared by passing chlorine gas through a solution of the yellow prussiate, two molecules of potassium being thereby abstracted from it, with the formation of potassium chloride as a secondary product. The red prussiate is used in the manufacture of sensitive paper for making blue-prints.

HYDRODICTYON, a genus of the family *Chlorophyceæ* or green algæ. Each individual plant consists of a long cylindrical cell, attached to others at the ends, forming a mesh in polygonal shape. The plant is freely moving, and its greatest length is one foot. It is familiarly known as «water nets.»

HYDRODYNAMICS (ὕδωρ, water; δύναμις, force), or **HYDROMECHANICS**, is that part of Dynamics which treats of the motion or rest of fluids under the action of forces. A perfect fluid is defined as a body whose parts are perfectly free to move under the action of the smallest forces, or otherwise, as a body such that the reactions between any two portions of it are normal to the surface separating them. If there is any tangential drag tending to prevent the one portion of the substance from slipping past the other, the fluid is said to be *viscous*. A perfect fluid is an abstraction, like the material particle or the rigid body, but many of the ordinary fluids, like water, alcohol, air and other gases, are so slightly viscous that for many purposes they may be considered as perfect. The normal reaction, which alone we suppose to be present, is called the *pressure*, and is measured by the limit of the ratio of the force exerted on an element of surface to the area of the element, when both diminish without limit. The usual gravitational unit of pressure is the pound-weight per square inch, the usual scientific, absolute unit (see MECHANICS), is the dyne per square centimeter. The pressure of the atmosphere may be considered as equal to 1,000,000 dynes per square centimeter.

The fundamental theorem of hydrodynamics is that the pressure on an element of surface is independent of the direction of the normal to the surface. This may be proved by considering the equilibrium of a small tetrahedron, *ABCD*, Fig. 1, and resolving the forces on its faces in the direction *BD*. The pressure being normal, the forces on *ABD*, *BCD* have no component along *BD*, while if the pressures on *ABC*, *ACD*, and the areas of those sides are respectively p_1, p_2, S_1, S_2, their normals n_1, n_2, we have for equilibrium $p_1S_1 \cos(n_1, BD) = p_2S_2 \cos(n_2, BD)$. But $S_1 \cos(n_1, BD)$, $S_2 \cos(n_2, BD)$ are the projections of the areas on a plane perpendicular to *BD*, which are equal, therefore $p_1 = p_2$. If there are other forces applied to the fluid besides the pressure, such, for instance, as its weight, these will be proportional to the volume of the tetrahedron, and when its size is diminished indefinitely, the volume vanishes to the third order of small quantities, and may thus be neglected in comparison with the area, which is of the second order, so that the result is not affected.

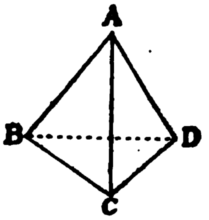


FIG. 1.

Hydrostatics.— We will first consider hydrostatics, or that part of our subject which deals with fluids at rest. Suppose that the fluid is subject to the action of forces whose components along the co-ordinate axes are equal to *X*, *Y*, *Z* per unit of mass. These we call bodily forces. Now consider the equilibrium of an infinitesimal rectangular parallelopiped, Fig. 2, whose edges, parallel to the co-ordinate axes, have lengths dx, dy, dz. Suppose that the mean value of the pressure on the side *ABCD*, which is at a distance x from the origin, is p, then the *X*-component of the force on this side is $p\,dydz$. On the side *EFGH*, which lies at a distance dx farther from the origin, the mean pressure will be $p + \frac{\partial p}{\partial x}dx$, and the component on the face *EFGH*, acting on the parallelopiped, being in the opposite direction will be $-\left(p + \frac{\partial p}{\partial x}dx\right)dydz$. Now if the density of the fluid is ρ, the amount of matter in the parallelopiped, being the product of the density and volume, will be $\rho dxdydz$, and the force exerted upon it in the *X*-direction will be $X\rho dxdydz$. We must therefore have for equilibrium

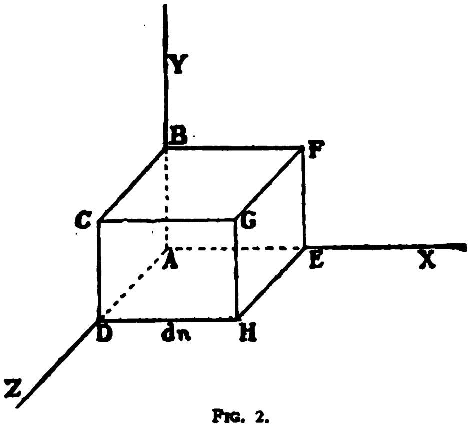


FIG. 2.

$$p\,dydz - \left(p + \frac{\partial p}{\partial x}dx\right)dydz + \rho X dxdydz = 0,$$

and passing to the limit by decreasing the dimensions, p will be the pressure at any point, and dividing by $dxdydz$, we have

$$\rho X = \frac{\partial p}{\partial x}$$

In a similar manner we have

$$\rho Y = \frac{\partial p}{\partial y}, \qquad (1)$$

$$\rho Z = \frac{\partial p}{\partial z}.$$

Thus the fluid can be in equilibrium only under the influence of bodily forces such that the components of the bodily forces, multiplied by the density, are the derivatives of the same functions of the co-ordinates. Now there is in general a physical relation between the pressure of a fluid and the density at any point. If we put

$$P = \int \frac{dp}{\rho}, \quad \frac{dP}{dp} = \frac{1}{\rho},$$

we have

$$\frac{\partial P}{\partial x} = \frac{dP}{dp}\frac{\partial p}{\partial x} = \frac{1}{\rho}\frac{\partial P}{\partial x}; \quad \frac{\partial P}{\partial y} = \frac{dP}{dp}\frac{\partial p}{\partial y} = \frac{1}{\rho}\frac{\partial p}{\partial y},$$

$$\frac{\partial P}{\partial z} = \frac{dP}{d\rho}\frac{\partial p}{\partial z} = \frac{1}{\rho}\frac{\partial p}{\partial z},$$

and our equations (1) become

$$(2)\qquad X=\frac{\partial P}{\partial x},\quad Y=\frac{\partial P}{\partial y},\quad Z=\frac{\partial P}{\partial z}.$$

Now this is the condition that the bodily forces are *conservative*. (See MECHANICS). In that case the potential energy for unit mass is called the *potential* of the forces, and will be denoted by V. Thus we shall have $P=-V+\text{const.}$, and $dV=-dP=-\frac{dp}{\rho}$. If two fluids of different densities are in contact, we have at their common surface

$$-dp=\rho_1 dV=\rho_2 dV,$$

so that

$$(\rho_1-\rho_2)dV=0,$$

and since $\rho_1-\rho_2$ is not zero we must have $dV=0$, $dp=0$. Consequently the surface of separation is a surface of constant potential and constant pressure. In the case of gravity we have, if the Z-axis is measured vertically upward, $V=gz$, so that the surfaces of constant V are horizontal planes, and a surface where water is in contact with the atmosphere must be a horizontal plane, or level surface, the pressure being the constant atmospheric pressure. If we suppose the fluid to be incompressible, we have ρ constant, $P=p/\rho$,

$$(3)\qquad \frac{p}{\rho}=-V+\text{const.}=-gz+\text{const.},$$

$$(4)\qquad p=-g\rho z+\text{const.},$$

so that, if we neglect the atmospheric pressure, and count the depth from the plane $z=0$, we have the fundamental theorem for heavy liquids, namely, that the pressure is proportional to the depth. This may be proved experimentally by placing a well-fitting plate under a tube, Fig. 3, communicating with a vessel of any shape, and holding the plate up by a wire hung from a balance, while water is poured in above. The weight required to hold the plate up is found to be independent of the shape of the vessel, and to depend only on the depth and the area of the plate. The vase and plate may also be immersed in liquid, while, instead of liquid within, weights are placed on the plate; the weight supported will then be proportional to the depth.

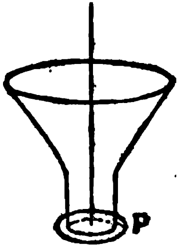


FIG. 3.

Consider now a gas, or compressible fluid, satisfying the law of Boyle and Mariotte,

$$p=a\rho.$$

Accordingly,

$$(5)\qquad P=\int\frac{dp}{\rho}=\int\frac{a\,d\rho}{\rho}=a\log\rho+\text{const.},$$

and

$$(6)\qquad V=gz=c-a\log\rho,$$

$$(7)\qquad \rho=\rho_0 e^{-\frac{gz}{a}}.$$

Thus as we ascend to heights in arithmetical progression the density decreases in geometrical progression, becoming zero at an infinite height. From equation (7) the barometric formula is obtained by which heights are found from barometer readings. The law of Boyle assumes constant temperature. It is, however, more likely that the temperature varies in accordance with what is called convective equilibrium, so that if a portion of air is hotter than the stratum in which it lies it will rise, and, cooling and expanding, will eventually find a layer of the same density and temperature as its own. The principles of thermodynamics give us the relation between pressure and temperature when the rarefaction is adiabatic, that is, when no heat is lost or gained by the air,

$$p=b\rho^{k}$$

where κ is a constant for the gas, whose value is about 1.4. We then have

$$(8)\qquad V=gz=-\int b\kappa\rho^{k-2}d\rho=c-\frac{b\kappa\rho^{k-1}}{\kappa-1}$$

Since $\kappa>1$, ρ diminishes as z increases, and is equal to zero when $gz=c$, so that on this hypothesis the atmospheric has an upper limit.

Let us now consider the equilibrium of a solid body floating in a liquid. If we consider the body removed and the space that it occupied filled with water, since this water is in equilibrium, its weight is borne up by the pressure of the surrounding water, the effect of which is accordingly to apply to each portion of the water in question an upward force just equal to its weight. Now just the same forces must be the resultant of the pressures on the solid when it is substituted for the displaced water, so that it is borne up by a force equal to the weight of the displaced water. This is the Principle of Archimedes. Since the resultant of the weight of all the displaced water is a single force applied at its centre of mass, the resultant upward thrust on the floating body is applied at a point coinciding with the centre of mass of the displaced water. This point is called the *centre of buoyancy* of the body. If the body is to be in equilibrium, according to the principles of statics of a rigid body, its weight must be equal to that of the displaced body, and its centre of mass and centre of buoyancy must be in the same vertical line. If the first condition is satisfied, but not the second, the body will float, but will be subject to a turning couple.

Suppose the body floats without being wholly immersed. A plane which cuts off from the body a volume equal to the volume of water having an equal weight is called a *plane of flotation*, and if we draw all such planes they will envelope a surface called the *surface of flotation*. For every plane of flotation there will be a centre of buoyancy, and the locus of all these points is called the *surface of buoyancy*. Suppose the floating body is displaced from its position of equilibrium by rotation through a small angle $\delta\theta$ about an axis OX through O, Fig. 4, and let WL, $W'L'$ be the original and final planes of flotation. By turning the figure until either is horizontal both positions of the body may be shown. Let B be the original centre of buoyancy, G the centre of mass of the floating body. Then if B were the centre of buoyancy in the second position, the body would be acted on by the couple of which either arm would be the weight

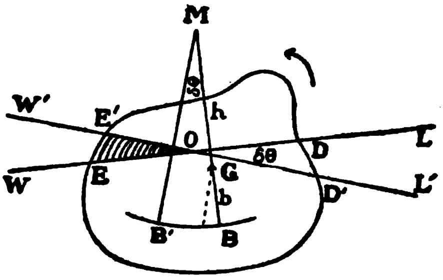


FIG. 4.

$W = mg$, and the arm the horizontal projection of BG, $b\delta\theta$, where $b = BG$. The moment of the couple tending to further displace the body will then be $Wb\delta\theta$. But this is not the only couple, for the immersed part is not the same as before, the volume of the wedge EOE' having become immersed, giving rise to an upward thrust, and the wedge DOD' having emerged and lost its buoyancy, both these causes giving rise to a turning moment in the same direction, and opposite to that previously found. Since the volume under water is to be the same in both positions, the volume of the wedges of immersion and emersion must be equal. Since the wedges are infinitely thin, the thickness at any point x, y in the plane of flotation is $z = y\delta\theta$. The condition for equality of volumes is then

$$(9) \qquad \iint z\,dx\,dy = \delta\theta \iint y\,dx\,dy = 0,$$

the integral being taken over the plane of flotation. This will be the case if the axis passes through the centre of mass of the area of flotation. The thrust on any element of volume $d\tau = z\,dx\,dy$ being $g\rho\,d\tau$, the moment about the X-axis will be

$$(10) \qquad L' = \iiint g\rho y\,d\tau = g\rho\delta\theta \iint y^2\,dx\,dy$$
$$= g\rho\delta\theta S\kappa_x^2,$$

where κ_x is the square root of the mean of the squares of the distances of the elements from the X-axis, or the so-called radius of gyration of the area of flotation about the X-axis, and S is the area of flotation. In like manner the moment about the Y-axis is

$$(11) \qquad M' = -\iiint g\rho x\,d\tau = -g\rho\delta\theta \iint xy\,dx\,dy.$$

There are always two axes at right angles to each other, called *principal axes*, for which the integral above vanishes, and for such an axis a displacement about it gives rise only to a couple about that axis. Subtracting this couple L' from the one previously found we obtain for the magnitude of the *righting couple*

$$(12) \qquad L = g\delta\theta(\rho S\kappa_x^2 - mb).$$

It is evident that in moving the point of application of the thrust from the centre of mass of one wedge to that of the other, the centre of buoyancy will be moved in a parallel direction, so that, in the limit, this direction being that of the plane of flotation, the line BB' will be parallel to that plane, or the tangent to the surface of buoyancy is parallel to the corresponding plane of flotation. It is also evident that the body is under the same forces that it would be if the surface of buoyancy were material and rested on a horizontal plane, for the reaction would be vertical and equal to the weight of the body.

If B' be the new centre of buoyancy, and we draw verticals from B and B', they will be normals to the surface of buoyancy and will intersect at M, the centre of curvature of the section of the surface of buoyancy. This point is called *the metacentre*, and its distance h_x above G the *metacentric height*. Evidently for stable equilibrium, or a positive righting couple, M must be above G. The arm of the couple being the horizontal projection of MG is equal to $h_x\delta\theta$ and we have $L = mgh_x\delta\theta$. Inserting this in equation (12) we obtain for the metacentric height

$$(13) \qquad mh_x = \rho S\kappa_x^2 - mb,$$

and dividing by m and writing $V = m/\rho$ for the volume of displaced liquid,

$$(14) \qquad h_x = \frac{S\kappa_x^2}{V} - b.$$

The equilibrium is stable or unstable according as this is positive or negative.

For the displacement about the Y-axis we have in like manner a couple proportional to the angle of displacement, with a new metacentric height,

$$(15) \qquad h_y = \frac{S\kappa_y^2}{V} - b,$$

where κ_y is the radius of gyration about the Y-axis. It is evident that the metacentric height is greater for a displacement about the shorter principal axis of the plane of flotation. Thus it is easier to roll a ship than to tip it endwise. The above theorems concerning the surfaces of flotation and buoyancy are due to Dupin.

If the floating body is totally submerged, like a submarine boat, only the first moment $mgb\delta\theta$ comes into play, S being zero, and the centre of buoyancy becomes the metacentre. The stability is in this case only secured by placing the centre of gravity low.

HYDROKINEMATICS.—We will now consider the motions possible to a fluid, without regard to the forces causing them. Let the velocity at a point be the vector q, with components u, v, w, and let us consider the quantity of fluid entering or leaving any closed surface in the unit of time. The amount of fluid which crosses the element of surface dS, Fig. 5, with a velocity q would in unit time, if q were

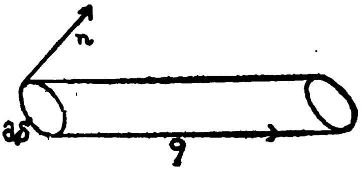


FIG. 5.

constant, fill a prism on the base dS with a slant height q. If n is the normal to dS, the volume of this prism is $dSq\cos(qn)$, and the mass of fluid in it $dS\,\rho q\cos(qn)$, or using the formula for the projection of q on n (see MECHANICS, equation (12)),

$$dS\,\rho q_n = dS\rho\{u\cos(nx)+v\cos(ny)+w\cos(nz)\}.$$

Consequently if we consider any closed surface, whose outward normal is n, we have for the whole outflow in unit time the surface integral

$$(16)\qquad \Phi = \iint \rho q_n dS = \iint \rho[u\cos(nx) + v\cos(ny) + w\cos(nz)]dS.$$

But we may find a different expression for the same quantity, by considering the elements of volume. Consider the parallelopiped of Fig. 2, and let u be the mean velocity on the side $ABCD$, $u+\frac{\partial u}{\partial x}dx$ on the opposite side $EFGH$. Then the inflow on the first side will be $\rho u dy dz$; while the outflow through the second will be $\left\{\rho u + \frac{\partial(\rho u)}{\partial x}dx\right\} dy dz$. The total outflow will thus be

$$\frac{\partial(\rho u)}{\partial x}dx dy dz.$$

In a similar manner we find the outflow through the two remaining pairs of sides to depend on the other two components. From the whole surface we accordingly have the outflow

$$\left\{\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}\right\}dx dy dz,$$

and for the outflow per unit volume we have

$$(17)\qquad \frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}.$$

On account of this kinematical interpretation, if we have any vector F, whose components X, Y, Z are functions of the co-ordinates of a point, the expression

$$(18)\qquad \frac{\partial X}{\partial x}+\frac{\partial Y}{\partial y}+\frac{\partial Z}{\partial z}$$

is called the *divergence* of the vector, and will be abbreviated div F. Summing up the outflow for all the elements of volume, inside the surface S, it is evident that the volume integral thus found must be equal to the surface integral Φ. Thus we have

$$(19)\qquad \iint \rho\{u\cos(nx)+v\cos(ny)+w\cos(nz)\}dS = \iiint\left\{\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}\right\}dx dy dz.$$

This may be taken as a kinematical proof of the *Divergence Theorem,* due to Gauss and Green, in which, for any vector function which is continuous and has a definite value at every point in the volume within S,

$$(20)\qquad \iint\{X\cos(nx)+Y\cos(ny)+Z\cos(nz)\}dS = \iiint\left\{\frac{\partial X}{\partial x}+\frac{\partial Y}{\partial y}+\frac{\partial Z}{\partial z}\right\}dx dy dz,$$

or in more abbreviated notation,

$$(20)\qquad \iint F_n dS = \iiint \operatorname{div} F\cdot d\tau.$$

The surface-integral in (20) is called the *flux* of the vector F through the surface S. If we have any continuously distributed vector-function F, that is, one whose components X, Y, Z are continuous functions of the point x, y, z, we may draw curves having the property that at every point on a curve its tangent has the direction of the vector F. The differential equations of these curves are

$$\frac{dx}{X}=\frac{dy}{Y}=\frac{dz}{Z}=\frac{ds}{F},$$

and the curves are called *lines* of the vector F. For instance, lines of the vector q are called *lines of flow*. If we draw all the lines of the vector passing through a closed contour, we shall obtain a tubular surface called a *tube* of the vector, Fig. 6.

If the fluid is incompressible, as much fluid must flow out from as into any volume, so that the total outflow is zero. The density is then constant, and we have, dividing (17) by ρ,

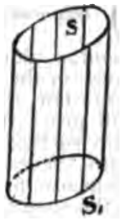


FIG. 6.

$$(21)\qquad \operatorname{div} q = \frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=0.$$

A vector whose divergence is zero is said to be *solenoidal* (σωλήν, a tube), for its tubes have the property that the flux across a cap, or portion of a surface bounded by the tube, is the same wherever the surface be drawn. Analytically, applying the divergence theorem to the portion of space bounded by a portion of such a tube and two caps forming ends, since along the sides of the tube the normal component vanishes, that portion of the flux in (20) is zero. Accordingly the flux through both ends is zero, or the flux out through one is equal to that in through the other. Or, looking in the direction of the vector-lines, the flux across any cap is the same. If we consider a tube of infinitesimal cross-section, and S is the area of a right section, since the flux is FS, which is constant for the tube, the magnitude of the vector F is inversely proportional to the area of the cross-section.

If the liquid is not incompressible the total outward flux is equal to the time-rate of decrease of the mass inside the surface, S, so that, the mass in an element of volume $d\tau = dx\,d\omega\,dz$ being $\rho d\tau$, we have

$$(22)\qquad -\frac{\partial m}{\partial t} = -\frac{\partial}{\partial t}\iiint \rho d\tau = \iint \rho q_n dS = \iiint \operatorname{div}(\rho q)d\tau.$$

Now since the volume over which we integrate is independent of the time, we may differentiate under the integral sign; also, both integrals being taken over the same volume, we may combine them into one,

$$(23)\qquad \iiint\left\{\frac{\partial\rho}{\partial t}+\operatorname{div}(\rho q)\right\}d\tau=0.$$

This equality holding for any volume whatever, the integrand must vanish, so that we have

$$(24)\qquad \frac{\partial\rho}{\partial t}+\frac{\partial(\rho u)}{\partial x}+\frac{\partial(\rho v)}{\partial y}+\frac{\partial(\rho w)}{\partial z}=0.$$

This is the so-called *equation of continuity,* the term arising from the continuity of existence of mass, none being created or destroyed, but being conveyed without change from place to place.

Besides the surface- and volume-integrals dealt with above, we need to consider certain line-integrals. If we resolve the vector q along the direction of the tangent to a curve running from A to B, and multiply by the length of the arc ds, and integrate from A to B along the curve, the line-integral

$$(25)\qquad \int q_s ds=\int(udx+vdy+wdz)$$

is called the *circulation* along the curve. If we describe the curve in the reverse direction, the integral changes sign. If the curve is a closed one, we shall prove the line-integral to be equal to a certain surface-integral over any surface S which has the contour in question as a boundary. Suppose first the contour is a plane curve and the surface is a plane. Let us divide the area up into infinitesimal rectangles by lines parallel to the axes of X and Y, Fig. 7. If we then find the circulation around each of the rectangles in the same direction, we shall have gone around all the sides common to two adjacent rectangles twice in opposite directions, so that those parts of the circulation will have destroyed each other, and there will remain only those parts which belong to the original contour. Accordingly the integral around the contour is equal to the sum of all these around the infinitesimal rectangular contours. Consider one of these, $ABCD$, Fig. 8. Along AC the tangential component is u, and the contribution to the integral udx. Along BD the value of u is $u+\frac{\partial u}{\partial y}dy$, and since we are going in the opposite direction the contribution to the integral is $-\left(u+\frac{\partial u}{\partial y}dy\right)dx$. Along AB the tangential component is v, and, since we are moving from B to A, the contribution to the integral is $-vdy$. Along CD the tangential component is $v+\frac{\partial v}{\partial x}dx$ and the contribution $\left(v+\frac{\partial v}{\partial x}dx.\right)dy$. Adding these four we have

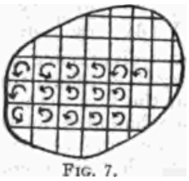


FIG. 7.

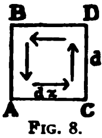


FIG. 8.

$$\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right)dxdy,$$

and summing for all the rectangles,

$$(26)\qquad \int q_s ds=\iint\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right)dxdy,$$

which is a particular case of our theorem.

If the contour is not a plane curve, so that the surface S is not plane, let us by drawing a series of planes parallel to one of the co-ordinate planes divide it into infinitesimal strips, Fig. 9, and then by drawing planes alternately parallel to the two other co-ordinate planes divide each strip into infinitesimal triangles each having one side parallel to each coordinate plane. As before, the sum of the circulations around all the triangles is equal to the circulation around the contour. Let us consider one of these triangles, BCD, Fig. 10, and let A be the point from which lines drawn parallel to the co-ordinate axes will pass through B, C, D. Again, circulation around BCD is equivalent to the sum of the circulations around the triangles ABC, ACD, ADB, the projections of BCD parallel to the co-ordinate planes. Let the areas of these four triangles be respectively dS, $dS_x=dS\cos(nx)$, $dS_y=dS\cos(ny)$, $dS_z=dS\cos(nz)$, n being the normal to S. Then we have, applying (26) to the three contours,

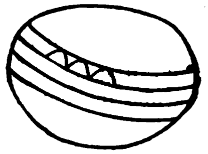


FIG. 9.

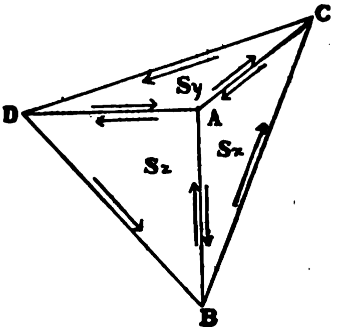


FIG. 10.

$$\int\limits_{ABCA} q_s ds=\left(\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z}\right)dS_x,$$

$$\int\limits_{ACDA} q_s ds=\left(\frac{\partial u}{\partial z}-\frac{\partial w}{\partial x}\right)dS_y,$$

$$\int\limits_{ADBA} q_s ds=\left(\frac{\partial v}{\partial x}-\frac{\partial u}{\partial y}\right)dS_z,$$

and consequently

$$\int_{BCDB} q_s ds = \left\{ \left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right) \cos (nx) + \left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) \cos (ny) + \left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right) \cos (nz) \right\} dS.$$

Summing up for all the infinitesimal triangles, we find the surface-integral over the surface S to be equal to the circulation around the contour.

$$(27) \quad \int (udx+vdy+wdz) = \iint \left\{ \left(\frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}\right) \cos (nx) + \left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) \cos (ny) + \left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right) \cos (nz) \right\} dS.$$

This is known as Stokes's theorem.

If we define a vector ω with the components ξ, η, ζ,

$$(28) \quad 2\xi = \frac{\partial w}{\partial y} - \frac{\partial v}{\partial z}, \quad 2\eta = \frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}, \quad 2\zeta = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y},$$

we have the integrand in the surface-integral in (27),

$$2[\xi \cos (nx) + \eta \cos (ny) + \zeta \cos (nz)] = 2\omega_n,$$

as the component of 2ω normal to the surface S. The vector 2 is called the *curl* of q, for the reason that if the lines of the vector "curl" about in any region, so that the tangential component along a closed curve always has the same sign, the surface-integral, and hence the curl, cannot vanish. We way write Stokes's theorem in the abbreviated form

$$(27) \quad \int q_s ds = \iint (\text{curl } q)_n dS.$$

As an example of the kinematical significance of the curl, let us consider a portion of fluid which revolves like a rigid body about the Z-axis. We then have $u = -ay$, $v = ax$, where a is a constant representing the angular velocity. We thus have

$$2\zeta = \frac{\partial v}{\partial x} - \frac{\partial u}{\partial y} = 2a.$$

Or applying Stokes's theorem to a circle with centre on the axis of rotation, since $q = ar$,

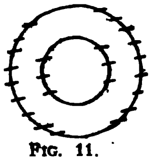


Fig. 11.

the line-integral is $2\pi r . q = 2\pi r^2 a$, which is equal to the area of the circle multiplied by $2a$, which must represent the curl. Thus we find that the curl of the velocity is twice the angular velocity with which an element of fluid is revolving. On this account the vector ω has received the name of *vorticity*, and fluid moving so that ω is not zero is said to move vortically. As the difference between vortical and non-vortical motion is very important, we may illustrate it as follows: It is possible that fluid may circulate in a region either vortically or non-vortically. Suppose that the fluid is filled with short straws repre-

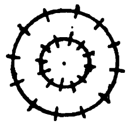


Fig. 12.

sented by the short lines in Figs. 11 and 12; if, as the fluid moves about, these all remain parallel to their original direction, the flow is non-vortical, Fig. 11; if they turn, the flow is vortical, Fig. 12. Thus it is impossible to tell by merely looking at a diagram of stream-lines whether the flow is vortical or not.

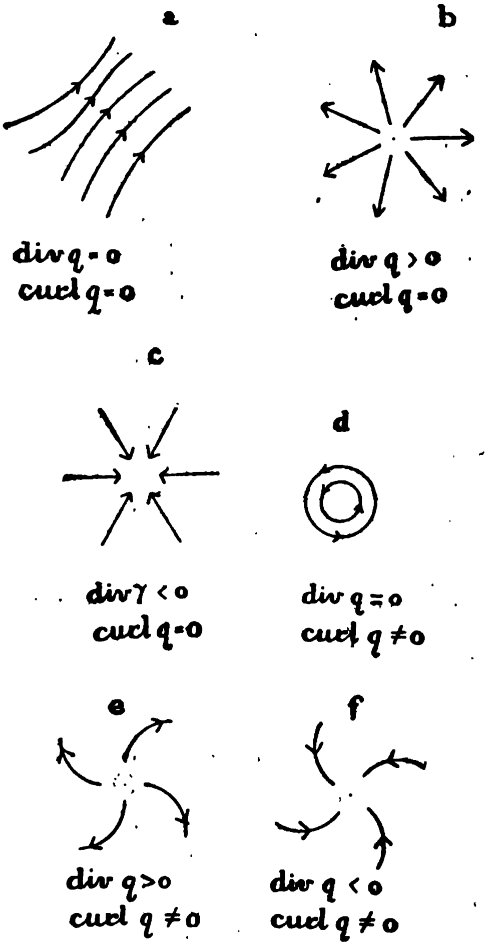


Fig. 1

It will be shown later that the divergence and curl of a vector function are characteristic of it, and that if they are known everywhere the complete nature of the vector is known. They are quite independent of each other, as is illustrated in Fig. 13, which shows regions where the divergence and curl are zero or not, independently.

Non-vortical Motion.—Let us first examine non-vortical motion, that is, where curl $q=0$ everywhere. If we connect A and B by any two curves ACB, ADB, the circulation around the closed path $ACBDA$ will be zero, hence the circulation from A to B will be the same by either path. Thus the circulation does not depend on the path, but only on the position of its ends, so that we have

$$(29)\qquad \int_A^B q_s ds = \phi_B - \phi_A,$$

which necessitates

$$q_s ds = u dx + v dy + w dz = d\phi$$
$$= \frac{\partial\phi}{\partial x}dx + \frac{\partial\phi}{\partial y}dy + \frac{\partial\phi}{\partial z}dz,$$

and therefore

$$(30)\qquad u=\frac{\partial\phi}{\partial x},\quad v=\frac{\partial\phi}{\partial y},\quad w=\frac{\partial\phi}{\partial z}.$$

The function ϕ is called the ***velocity-potential.*** The direction of the velocity q is everywhere normal to the equipotential surfaces $\phi=$ const., for if we move along the equipotential we have

$$d\phi = u dx + v dy + w dz = 0,$$

which is the condition that the vectors u, v, w, the velocity, and dx, dy, dz, the displacement, are perpendicular. According to the relation $q_s ds = d\phi$, we have the component of velocity in any direction $q_s = \frac{\partial\phi}{\partial s}$, equal to the space-rate of variation of potential in that direction; and since the velocity itself is equal to the rate of change of ϕ in the direction of the normal to the surface $\phi=$const., a vector related to a function ϕ by the relations (30) is called the ***gradient*** of the function. A vector which is thus derived from a potential function is called a ***lamellar*** vector.

As an example of lamellar flow, let us take the case in which the velocity is directed radially outwards from a given point a, b, c with a value depending on the distance $r=\sqrt{(x-a)^2+(y-b)^2+(z-c)^2}$ from that point, $q=f(r)$. The equipotential surfaces are concentric spheres, and we easily find the potential to be $\phi=\int f(r)dr$. For, since the direction cosines of r are $\cos(rx)=\frac{x-a}{r}$, $\cos(ry)=\frac{y-b}{r}$, $\cos(rz)=\frac{z-c}{r}$, we have the components of the velocity,

$$u=f(r)\frac{x-a}{r}=\frac{d\phi}{dr}\frac{\partial r}{\partial x}=\frac{\partial\phi}{\partial x},$$
$$(30)\qquad v=f(r)\frac{y-b}{r}=\frac{d\phi}{dr}\frac{\partial r}{\partial y}=\frac{\partial\phi}{\partial y},$$
$$w=f(r)\frac{z-c}{r}=\frac{d\phi}{dr}\frac{\partial r}{\partial z}=\frac{\partial\phi}{\partial z}.$$

The flux out through any of the concentric spheres is $M=4\pi r^2 q$, so that if the fluid is incompressible we must have

$$(31.)\qquad q=\frac{M}{4\pi r^2},\quad \phi=-\frac{M}{4\pi r},$$

where M is constant. The vector q is then solenoidal as well as lamellar, and the equation of continuity becomes

$$(32)\quad \operatorname{div} q=\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}=\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}+\frac{\partial^2\phi}{\partial z^2}=0.$$

This equation for ϕ is known as Laplace's equation, and the sum of the three partial derivatives of second order, which will be abbreviated as $\Delta\phi$, is called the *Laplacian* of q. Obviously the above flow cannot extend as far as $r=0$, for there the velocity would be infinite. Suppose that in a small region of volume τ at the centre liquid is being created just fast enough to supply the outflow, so that the volume M is created per unit of time. Such a region is called a ***source,*** and the whole system of flow is called a ***squirt.*** The quantity M is called the ***strength*** of the source, and the strength per unit of volume $M/\tau=\sigma$ the ***source-density.*** If we have several sources, and add their potentials, the resultant velocity will be obtained as the gradient of the sum. Thus a complicated vector-field may be represented by its potential function. The sources may be continuously distributed through a portion of space, then σ, the source-density, will be a function of the position of the point, and the total strength will be

$$(33)\qquad M=\iiint\sigma d\tau,$$

while the total potential will be

$$(34)\qquad \phi=-\frac{1}{4\pi}\iiint\frac{\sigma d\tau}{r},$$

where r represents the distance from the element $d\tau$ to the point where ϕ is calculated. The total flux through any closed surface will be

$$(35)\quad \iint q_n dS=\iint\frac{\partial\phi}{\partial n}dS=\iint(\operatorname{grad}\phi)_n dS,$$

or by the divergence theorem,

$$(36)\quad \iint q_n dS=\iiint\operatorname{div}q\cdot d\tau=\iiint\Delta\phi\cdot d\tau$$
$$=\iint(\operatorname{grad}\phi)_n dS.$$

Since this flux must be equal to the strength of all the sources within the surface of integration, we must have

$$(37)\qquad \iiint\Delta\phi\cdot d\tau=\iiint\sigma d\tau.$$

Now as this equality holds for any volume whatsoever, the integrands must be equal; accordingly we have

$$(38)\qquad \Delta\phi=\sigma,$$

as a consequence of equation (34). The equation (38) is called Poisson's equation. We may also prove the converse, namely, that if σ is given as a function of the point, the integral of equation (38) is given by (34). This is done by means of Green's theorem.

In the divergence theorem (20) let us put for the vector F the value $U\cdot\operatorname{grad}V$, where U and V are two functions, both of which, with their derivatives, are finite, singly-valued, and continuous in the region of integration. Then we have

$$X=U\frac{\partial V}{\partial x},\quad Y=U\frac{\partial V}{\partial y},\quad Z=U\frac{\partial V}{\partial z},$$

$$\frac{\partial X}{\partial x}+\frac{\partial Y}{\partial y}+\frac{\partial Z}{\partial z}=U\Delta V+\frac{\partial U}{\partial x}\frac{\partial V}{\partial x}+\frac{\partial U}{\partial y}\frac{\partial V}{\partial y}+\frac{\partial U}{\partial z}\frac{\partial V}{\partial z},$$

$$(39)\qquad \iint F_n dS=\iint U(\operatorname{grad} V)_n dS$$

$$=\iint U\frac{\partial V}{\partial n}\,dS$$

$$=\iiint\left\{U\Delta V+\frac{\partial U}{\partial x}\frac{\partial V}{\partial x}+\frac{\partial U}{\partial y}\frac{\partial V}{\partial y}+\frac{\partial U}{\partial z}\frac{\partial V}{\partial z}\right\}d\tau.$$

Interchanging the functions U and V and subtracting from (39), we have

$$(40)\qquad \iint\left\{U\frac{\partial V}{\partial n}-V\frac{\partial U}{\partial n}\right\}dS$$

$$=\iiint\left\{U\Delta V-V\Delta U\right\}d\tau.$$

The equations (39) and (40) are known as Green's Theorem. Let us apply it to two functions, one of which, U, is the reciprocal distance from a fixed point P, $U=1/r$. Let us apply the theorem to the whole extent of space, bounded by the infinite sphere, with the exception of a portion bounded by a small sphere with centre at P, which we exclude, on account of the infinite value of U at P. We must thus take the surface-integrals over the large and small spheres, the normals being in each case drawn away from the volume considered, or out in the first case, in in the second. Since the direction of the normal coincides with that of the radius of the sphere,

$$\frac{\partial(1/r)}{\partial n}=\pm\frac{\partial(1/r)}{\partial r}=\pm\frac{1}{r^2},$$

in the two cases respectively while $dS=r^2d\omega$, where $d\omega$ is the element of area of a sphere of radius unity, cut out by a cone of vertex P, having as base the element dS. Accordingly on either sphere.

$$(41)\qquad \iint V\frac{\partial(1/r)}{\partial n}dS=\mp\iint V d\omega,$$

and if V vanishes at $r=\infty$, the integral over the infinite sphere vanishes. If we now let the radius of the small sphere diminish without limit, the value of V to be taken is the value at P, so that

$$(42)\quad -\iint V\frac{\partial(1/r)}{\partial n}dS=-V_P\iint d\omega=-4\pi V_P.$$

On the other hand the surface-integral

$$\iint\frac{1}{r}\frac{\partial V}{\partial n}dS=r\iint\frac{\partial V}{\partial n}d\omega,$$

over the spheres vanishes for $r=\infty$, on account of the vanishing of $\frac{\partial V}{\partial n}$ to the second order, and for the small sphere in the limit, on account of the factor r. As for the volume-integrals we have seen in (31), (32), that any multiple of $1/r$ satisfies Laplace's equation, hence $\Delta(1/r)=0$, so that finally

$$(43)\qquad V_P=-\frac{1}{4\pi}\iiint\frac{\Delta V}{r}d\tau,$$

the integral being taken over all space. But this is the required theorem, the converse of (38).

Solutions of Laplace's equation can be found for the case of uniplanar flow, where the velocity is parallel to a given plane, and independent of the co-ordinate perpendicular thereto. A plane diagram then represents the flow. If the given plane is that of X, Y, Laplace's equation becomes

$$(44)\qquad \frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}=0.$$

An infinite number of solutions are furnished us by the method of functions of a complex variable $x+iy$, where i is the imaginary defined by $i^2=-1$.

If now we take any function $w=f(z)$ of the combination $z=x+iy$, on arranging it in powers of x, iy, all even powers of i will be real, all odd ones real multiples of i; accordingly w will be of the form $\phi+i\psi$, where ϕ, ψ are real functions of the two real variables x, y. Differentiating partially,

$$\frac{\partial w}{\partial x}=f'(z)\frac{\partial z}{\partial x}=f'(z),\quad \frac{\partial w}{\partial y}=f'(z)\frac{\partial z}{\partial y}=if'z=i\frac{\partial w}{\partial x},$$

$$\frac{\partial w}{\partial y}=\frac{\partial\phi}{\partial y}+i\frac{\partial\psi}{\partial y}=i\frac{\partial w}{\partial x}=i\frac{\partial\phi}{\partial x}-\frac{\partial\psi}{\partial x},$$

and equating real and imaginary parts,

$$(45)\qquad \frac{\partial\phi}{\partial x}=\frac{\partial\psi}{\partial y},\quad \frac{\partial\phi}{\partial y}=-\frac{\partial\psi}{\partial x}.$$

Differentiating the first equation by x, the second by y, and adding, we have

$$\frac{\partial^2\phi}{\partial x^2}+\frac{\partial^2\phi}{\partial y^2}=0,$$

and similarly

$$\frac{\partial^2\psi}{\partial x^2}+\frac{\partial^2\psi}{\partial y^2}=0.$$

Thus either function ϕ or ψ derived from any function of a complex variable gives us a case of uniplanar flow of an incompressible fluid. From the equations (45) we obtain by cross-multiplication

$$(46)\qquad \frac{\partial\phi}{\partial x}\frac{\partial\psi}{\partial x}+\frac{\partial\phi}{\partial y}\frac{\partial\psi}{\partial y}=0,$$

which is the condition that the normals to the family of curves $\phi=$ const. and those of the family $\psi=$ const. intersect each other at right angles. Such families are called orthogonal. For instance, the function

$$(47)\qquad w=\frac{1}{z}=\frac{1}{x+iy}=\frac{x-iy}{x^2+y^2}$$

gives

$$(48)\qquad \phi=\frac{x}{x^2+y^2},\quad \psi=\frac{-y}{x^2+y^2},$$

and the curves

$$\frac{x}{x^2+y^2}=\text{const.},\quad \frac{y}{x^2+y^2}=\text{const.}$$

are a set of circles tangent to the Y-axis and the X-axis, respectively, the two sets intersecting each other at right angles.

The flux across any cylindrical surface whose generator has the length unity parallel to the Z-axis, and which intersects the XY-plane in a curve from A to B, is, if $\rho = 1$,

$$(49)\quad \Phi_{AB} = \int_A^B q_n ds = \int_A^B \frac{\partial\phi}{\partial n} ds$$

$$= \int_A^B \left\{ \frac{\partial\phi}{\partial x}\cos(nx) + \frac{\partial\phi}{\partial y}\cos(ny) \right\} ds.$$

But if the normal lies on the right as we go along the curve, Fig. 14,

$$\cos(nx)ds = dy, \quad \cos(ny)ds = -dx.$$

Using these values and equations (45), we have for the flux

$$(50)\quad \Phi_{AB} = \int_A^B \frac{\partial\psi}{\partial x}dx + \frac{\partial\psi}{\partial y}dy = \psi_B - \psi_A,$$

so that the quantity of liquid crossing the surface does not depend on the curve joining

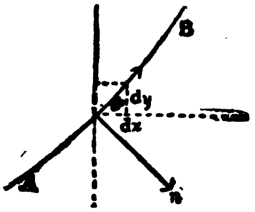


FIG. 14.

AB, but is the same for one as for another, as must be the case if the liquid is incompressible. The function ψ is called the ***flux-function***, and since if $\psi_B = \psi_A$, no liquid crosses, it is evident that the curves ψ = const. are stream-lines. It is evident from equations (45) that either of the two functions ϕ, ψ may be taken for the velocity-potential, the other being taken for the flux-function. Functions satisfying equations (45) are called *conjugate functions*, and the two states of flow just described are called conjugate. In the case just investigated, the two conjugate flows happened to be identical; this is not generally the case.

For instance, consider the functions $w = \log z$, and introducing polar co-ordinates r, θ,

$$(51)\quad w = \log z = \log(x + iy)$$

$$= \log\{r(\cos\theta + i\sin\theta)\} = \log\{re^{i\theta}\} = \log r + i\theta.$$

Thus we may put

$$(52)\quad \phi = \log r, \quad \psi = \theta,$$

obtaining a radial flow, or uniplanar squirt, with circular equipotentials, or

$$(53)\quad \phi = \theta, \quad \psi = \log r,$$

obtaining a circular flow with radial equipotentials.

Vortical Motion.—Let us now free ourselves from the restriction that the curl of the velocity vanishes. There will then be no velocity-potential in regions where there is curl. Lines whose tangent has everywhere the direction of the vector ω, the vorticity, are called *vortex-lines*, and tubes generated by such lines vortex-tubes, tubes of infinitesimal cross-section being termed vortex-filaments. The fluid within such a tube is called a vortex. Since the curl of any vector is solenoidal, as is seen by differentiating the equations (28) to find the divergence, the vorticity is a solenoidal vector and its tubes have the solenoidal property that the vorticity in any filament is inversely proportional to the area of the cross-section of the filament. The product $S\omega$, which is constant for the filament, is called the strength of the filament. Consequently the vorticity cannot vanish at any point on a tube, nor can the cross-section. The vortex-tubes must accordingly be closed, or end at a free surface of the liquid, as do those vortices formed by an oar at the surface of water.

The properties of vortex-motion were first investigated in an important paper by Helmholtz in 1858. Following him we shall now show that any continuous flow vanishing at infinity may be represented as the sum of a lamellar and a solenoidal part, and that the solenoidal part may be represented as the curl of another vector. Suppose that ϕ be the potential of the lamellar part, Q the vector with components U, V, W, whose curl represents the solenoidal part. Then we assume

$$(54)\quad \begin{aligned} u &= \frac{\partial\phi}{\partial x} + \frac{\partial W}{\partial y} - \frac{\partial V}{\partial z}, \\ v &= \frac{\partial\phi}{\partial y} + \frac{\partial U}{\partial z} - \frac{\partial W}{\partial x}, \\ w &= \frac{\partial\phi}{\partial z} + \frac{\partial V}{\partial x} - \frac{\partial U}{\partial y}. \end{aligned}$$

Finding the divergence of q we have

$$(55)\quad \text{div}\, q = \frac{\partial u}{dx} + \frac{\partial v}{\partial y} + \frac{\partial w}{\partial z} = \Delta\phi,$$

since the divergence of the curl vanishes. But by (43) we have

$$\phi = -\frac{1}{4\pi}\iiint \frac{\Delta\phi}{r} d\tau = -\frac{1}{4\pi}\iiint \frac{\text{div}\, q}{r} d\tau.$$

Since q represents a continuous flow, div q is finite. Accordingly we find that the lamellar part of the flow is completely determined by the distribution of its divergence.

Secondly, find the curl of q.

$$(56)\quad 2\xi = \frac{\partial w}{\partial y} - \frac{\partial v}{\partial z} = \frac{\partial}{\partial y}\left\{\frac{\partial\phi}{\partial z} + \frac{\partial V}{\partial x} - \frac{\partial U}{\partial y}\right\}$$

$$-\frac{\partial}{\partial z}\left\{\frac{\partial\phi}{\partial y} + \frac{\partial U}{\partial z} - \frac{\partial W}{\partial x}\right\}$$

$$= -\Delta U + \frac{\partial}{\partial x}\left\{\frac{\partial U}{\partial x} + \frac{\partial V}{\partial y} + \frac{\partial W}{\partial z}\right\}$$

Since the vector Q is as yet undetermined except as to its curl, let us assume it to be solenoidal, which will make the divergence in (56) vanish, giving

$$(57)\quad 2\xi = -\Delta U, \quad 2\eta = -\Delta V, \quad 2\zeta\Delta = -W.$$

As before, we find the integrals of these equations to be

$$(58)\quad U = \frac{1}{2\pi}\iiint \frac{\xi}{r} dz, \quad V = \frac{1}{2\pi}\iiint \frac{\eta}{r} dv,$$

$$W = \frac{1}{2\pi}\iiint \frac{\zeta}{r} d\tau.$$

The integrals are to be taken over all space, but as any part of space where the vorticity vanishes will contribute nothing to the integrals, we may suppose them restricted to the vortices. Thus we see that the solenoidal part of the flow q, which is due to the vortices, is completely determined by the distribution of curl q. Thus the statement is justified that a continuous vector-function is completely determined by its divergence and curl. Kinematically we may say that any flow is the resultant of squirts and vortices. The vector Q, whose components are formed in the manner of potentials from the components of 2ω, is called the *vector-potential* of 2ω.

Thus the velocity due to a vortex is the curl of the vector-potential of twice the vorticity. We may find this velocity by differentiation. Let us distinguish the point of integration from the point for which the potentials are calculated and by which we differentiate, by attaching an accent to the co-ordinates of the former. We have

$$(59)\quad \begin{aligned} u &= \frac{\partial W}{\partial y} - \frac{\partial V}{\partial z} \\ &= \frac{1}{2\pi}\left[\frac{\partial}{\partial y}\int\int\int\frac{\zeta'}{r}d\tau' - \frac{\partial}{\partial z}\int\int\int\frac{\eta'}{r}d\tau'\right] \\ &= \frac{1}{2\pi}\int\int\int\left\{\zeta'\frac{\partial}{\partial y}\left(\frac{1}{r}\right) - \eta'\frac{\partial}{\partial z}\left(\frac{1}{r}\right)\right\}d\tau'. \end{aligned}$$

Thus the portions of velocity contributed by the element of the vortex $d\tau'$ are

$$(60)\quad \begin{aligned} du &= \frac{1}{2\pi r^3}\{\zeta'(y'-y) - \eta'(z'-z)\}\,d\tau', \\ dv &= \frac{1}{2\pi r^3}\{\xi'(z'-z) - \zeta'(x'-x)\}\,d\tau', \\ dw &= \frac{1}{2\pi r^3}\{\eta'(x'-x) - \xi'(y'-y)\}\,d\tau'. \end{aligned}$$

These are immediately seen to be, aside from the factor $1/2\pi r^3$, the projections of the parallelogram whose sides are the vectors ω' and r the vector from x', y', z' to x, y, z. If dq be the magnitude of the resultant, we accordingly obtain

$$(61)\quad dq = \frac{\omega' \sin(\omega' r)}{2\pi r^2}\,d\tau',$$

the direction of dq being perpendicular to both ω' and r, as shown by (60).

Let us take for the element of volume $d\tau'$ a length ds of a vortex-filament of cross-section S. Then $d\tau' = Sds$, and since $S\omega' = \kappa$, the strength of the filament

$$(62)\quad dq = \frac{\kappa ds \cdot \sin(\omega r)}{2\pi r^2}.$$

The velocity is connected with the vorticity in the same way that the magnetic field due to an electric current is connected with the current-density, equation (62) giving us the magnetic field produced by a current of strength $\kappa/2\pi$.

HYDRODYNAMICS.— We now arrive at the subject of Hydrodynamics proper, in which we take account of the forces that are capable of producing the states of flow that have been previously described. Suppose that the co-ordinates of a particle are x, y, z, then $u = \frac{dx}{dt}$, $v = \frac{dy}{dt}$, $w = \frac{dz}{dt}$. The principles of dynamics tell us that the product of the mass by the acceleration of any particle is equal to the resultant of all the forces applied to it. Taking the mass contained in the element of volume $d\tau$, and the resultant of the bodily forces and pressures, as found under the treatment of hydrostatics,

$$(63)\quad \rho d\tau\frac{d^2x}{dt^2} = \rho d\tau\frac{du}{dt} = \left(\rho X - \frac{\partial p}{\partial x}\right)d\tau,$$

from which we obtain the equation with two similar ones,

$$(64)\quad \frac{du}{dt} = X - \frac{1}{\rho}\frac{\partial p}{\partial x},\quad \frac{dv}{dt} = Y - \frac{1}{\rho}\frac{\partial p}{\partial y},\quad \frac{dw}{dt} = Z - \frac{1}{\rho}\frac{\partial p}{\partial z}.$$

By the derivative $\frac{du}{dt}$ is meant the rate of change of velocity of a particular particle as it moves about. If we have any function F of the position of a particular particle, we may write its derivative

$$(65)\quad \frac{dF}{dt} = \frac{\partial F}{\partial t} + \frac{\partial F}{\partial x}\frac{dx}{dt} + \frac{\partial F}{\partial y}\frac{dy}{dt} + \frac{\partial F}{\partial z}\frac{dz}{dt},$$

where $\partial F/\partial t$ would be the rate of change of the function if the particle were at rest. The derivatives $\frac{dx}{dt}, \frac{dy}{dt}, \frac{dz}{dt}$ are the velocity-components u, v, w. Accordingly we have

$$(66)\quad \frac{dF}{dt} = \frac{\partial F}{\partial t} + u\frac{\partial F}{\partial x} + v\frac{\partial F}{\partial y} + w\frac{\partial F}{\partial z}.$$

We call this mode of differentiation *particle differentiation.*

Introducing this terminology, our equations of motion become

$$(67)\quad \begin{aligned} \frac{\partial u}{\partial t} + u\frac{\partial u}{\partial x} + v\frac{\partial u}{\partial y} + w\frac{\partial u}{\partial z} &= X - \frac{1}{\rho}\frac{\partial p}{\partial x}, \\ \frac{\partial v}{\partial t} + u\frac{\partial v}{\partial x} + v\frac{\partial v}{\partial y} + w\frac{\partial v}{\partial z} &= Y - \frac{1}{\rho}\frac{\partial p}{\partial y}, \\ \frac{\partial w}{\partial t} + u\frac{\partial w}{\partial x} + v\frac{\partial w}{\partial y} + w\frac{\partial w}{\partial z} &= Z - \frac{1}{\rho}\frac{\partial p}{\partial z}. \end{aligned}$$

These equations are due to Euler. These three equations, with the equation of continuity (24), and the physical relation between ρ and p furnish five equations for the determination of the five variables u, v, w, ρ, p, as functions of x, y, z, t.

Subtracting from both sides of the first of equations (67) the quantity

$$\frac{\partial}{\partial x}\left(\frac{q^2}{2}\right) = \frac{1}{2}\frac{\partial}{\partial x}\{u^2 + v^2 + w^2\} = u\frac{\partial u}{\partial x} + v\frac{\partial v}{\partial x} + w\frac{\partial w}{\partial x}$$

we obtain

$$(68)\quad \frac{\partial u}{\partial t} + w\left(\frac{\partial u}{\partial z} - \frac{\partial w}{\partial x}\right) - v\left(\frac{\partial v}{\partial x} - \frac{\partial u}{\partial y}\right) = X - \frac{\partial P}{\partial x} - \frac{\partial\left(\frac{q^2}{2}\right)}{\partial x}.$$

If the bodily forces are conservative and derived from a potential V, the right-hand member is the derivative of the quantity $-(V+P+q^2/2) = U$, and inserting the values of ξ, η, ζ,

$$(69)\quad \begin{aligned} &\frac{\partial u}{\partial t} + 2(w\eta - v\zeta) - \frac{\partial U}{\partial x}, \\ &\frac{\partial v}{\partial t} + 2(u\zeta - w\xi) - \frac{\partial U}{\partial y}; \\ &\frac{\partial w}{\partial t} + 2(v\xi - u\eta) - \frac{\partial U}{\partial z} \end{aligned}$$

If the motion is *steady*, that is, independent of t, the time-derivatives vanish. Then multiplying the equations (69) by dx, dy, dz respectively, adding and integrating along any curve, we obtain on the right the difference between the terminal values of $V + P + q^2/2$.

If the curve is either a stream- or vortex-line, that is, if dx, dy, dz are proportional either to u, v, w, or to ξ, η, ζ, the sum on the left will also vanish, so that along a stream-line or a vortex-line we have $V + P + q^2/2 = \text{const.}$ If the motion is non-vortical, the left-hand side of (69) vanishes, so that the above sum is constant throughout the fluid. In this case

(70) $$V + P + \tfrac{1}{2}q^2 = \text{const.},$$

this result being called Daniel Bernoulli's theorem.

If the fluid is incompressible, $P = p/\rho$, and if there are no bodily forces $V = 0$, so that (70) becomes

(71) $$\frac{p}{\rho} + \frac{1}{2}q^2 = \text{const.}$$

Accordingly where the velocity is small the pressure is large and vice-versa. By constricting the tube the velocity is made large and the pressure small. This is the principle of jet exhaust-pumps, like that of Bunsen, the air being sucked in at the narrow part of the jet. The same principle is used in the Venturi water-meter. The horizontal main being reduced in diameter in a certain portion and the difference of pressure at a point in that portion and in the main observed, the velocity is computed. If the pressure at the two cross-sections S_1 and S_2 is p_1, p_2, we have

(72) $$p_1 - p_2 = \frac{\rho}{2}(q_2^2 - q_1^2).$$

But since the flow is solenoidal, $S_1q_1 = S_2q_2$. Combining with (72),

(73) $$p_1 - p_2 = \tfrac{1}{2}\rho q_1^2\left\{\left(\frac{S_1}{S_2}\right)^2 - 1\right\},$$

which determines q_1 in terms of the pressure-difference. The efflux in unit time is $\rho q_1 S_1$.

For the adiabatic expansion of a gas,

(74) $$P = \frac{b\kappa\rho^{k-1}}{\kappa - 1} = \frac{b\kappa}{\kappa - 1}\left(\frac{p}{b}\right)^{\frac{k-1}{k}}.$$

We may use Bernoulli's theorem to calculate the efflux of gas from a reservoir. If we consider a point in the reservoir where the pressure is p, so far from the orifice that the air may be considered at rest and if the velocity at the orifice is q and the atmospheric pressure p_0, we have

(75) $$q^2 = 2b^{\frac{1}{\kappa}}\frac{\kappa}{\kappa - 1}\left\{p^{\frac{k-1}{k}} - p_0^{\frac{k-1}{k}}\right\},$$

which is the usual formula for the efflux of gases.

If the external force be gravity, $V = gz$, and we have for an incompressible fluid,

(76) $$\frac{p}{\rho} + gz + \tfrac{1}{2}q^2 = \text{const.}$$

If we again consider efflux from a reservoir whose upper free surface $z = z_1$ is so large that q is negligible, the pressure being that of the atmosphere, the same above and at the orifice where $z = z_2$, the velocity of efflux is given by

$$\frac{p_0}{\rho} + gz_1 = \frac{p_0}{\rho} + gz_2 + \tfrac{1}{2}q^2,$$

(77) $$q^2 = 2g(z_1 - z_2),$$

or the velocity of efflux is that acquired by a body falling freely from a height equal to that of the free surface above the orifice. This is the theorem of Torricelli, one of the oldest on hydrodynamics.

Wave-motion.— The case of uniplanar waves may be dealt with by the method of the complex variable. We shall find that the waves travel with constant velocity a and that it will simplify the problem if we impose upon the whole fluid a horizontal velocity equal and opposite to that of the waves. The waves then stand still and the motion is *steady*, as in the case of waves about an obstruction in a running river.

Let us consider waves in deep water. At a great depth the vertical motion will disappear, so that

$$u = -a, \quad v = 0, \quad \phi = -ax.$$

The function

$$w = -az + Ae^{-ikz} = -a(x+iy) + Ae^{-ik(x+iy)}$$

gives

$$\phi + i\psi = -a(x+iy) + Ae^{ky}(\cos kx - i\sin kx).$$

(78) $$\phi = -ax + Ae^{ky}\cos kx,$$
$$\psi = -ay - Ae^{ky}\sin kx.$$

When $y = -\infty$ this makes $\phi = -ax$ as required. The free surface of the water being composed of stream-lines is represented by one of the lines $\psi = \text{const.}$, and if we take the origin in the surface its equation is

(79) $$ay + Ae^{ky}\sin kx = 0,$$

which shows that y is a periodic function of x with the wave-length $\lambda = 2\pi/k$. The longer the wave-length, that is the smaller k, the more nearly does the exponential reduce to unity and the profile to a curve of sines. The velocity is given by

(80) $$u = \frac{\partial\phi}{\partial x} = \frac{\partial\psi}{\partial y} = -a - Ake^{ky}\sin kx,$$
$$v = \frac{\partial\phi}{\partial y} = -\frac{\partial\psi}{\partial x} = Ake^{ky}\cos kx,$$

(81) $$q^2 = u^2 + v^2 = a^2 + A^2k^2e^{2ky} + 2Ake^{ky}\sin kx.$$

So far we have merely kinematics. The dynamical relation required is that for steady motion,

(82) $$\frac{p}{\rho} + gy + \tfrac{1}{2}q^2 = C.$$

At the surface putting $p = 0$ and making use of (79),

$$gy + \tfrac{1}{2}\{a^2 + A^2k^2e^{2ky} - 2a^2ky\} = C.$$

Since the surface passes through the origin, putting $y = 0$,

$$C = \tfrac{1}{2}(a^2 + A^2k^2).$$

(83) $$(g - a^2k)y + \tfrac{1}{2}A^2k^2(e^{2ky} - 1) = 0.$$

This equation can be only approximately fulfilled, but if the height of the waves is so small in comparison with the wave-length that the square of $2ky$ may be neglected, developing the exponential gives

$$(g - a^2k + A^2k^3)y = 0,$$

giving the relation between the velocity and the wave-length.

(84) $$g - a^2k + A^2k^3 = 0.$$

If ky is small, the equation of the profile (79) is approximately

(85) $$y = -\frac{A}{a}\sin kx,$$

so that the height of the waves above the origin is $B = A/a$, inserting which in (84) gives

$$(86)\qquad a^2\left\{\frac{2\pi}{\lambda}\left(1-\frac{4\pi^2B^2}{\lambda^2}\right)\right\}=g.$$

For long waves we accordingly have $a^2=g\lambda/2\pi$, or the velocity of long waves in deep water is equal to the velocity acquired by a body in falling freely from a height equal to one-half the radius of a circle whose circumference is the wave-length.

In order to study the motions of the individual particles of water let us now impress upon the motion given by (80) a uniform velocity a in the X-direction. Equations (80) now give the motion with respect to axes traveling with the waves, so that in order to obtain the motion with respect to fixed axes we have to add a to the u of (80) and replace x by $x-at$, obtaining

$$(87)\qquad \begin{aligned} u &= -Ake^{ky}\sin k(x-at),\\ v &= -Ake^{ky}\cos k(x-at). \end{aligned}$$

If the displacement of a particle which when at rest was at x, y is ξ, η, the above values are $\frac{d\xi}{dt}$, $\frac{d\eta}{dt}$, and if we neglect the small change of velocity from x, y to $x+\xi$, $y+\eta$, we may integrate with respect to the time.

$$(88)\qquad \begin{aligned} \xi &= -Be^{ky}\cos k(x-at),\\ \eta &= -Be^{ky}\sin k(x-at). \end{aligned}$$

Thus each particle performs a uniform revolution in a vertical circle of radius Be^{ky} in the time $T=\frac{2\pi}{ka}=\frac{\lambda}{a}$. The rapidity of decrease of the motion as we go below the surface is seen by the fact that at a depth $y=-\lambda$ the amplitude has diminished in the ratio $e^{-2\pi}=.001867$. The form of the wave-profile is shown in Fig. 15, the crests being farther above the level than the troughs are below it. As the height increases the waves become sharper at the crest.

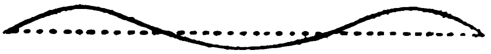


FIG. 15.

Vortex-motion.—Let us consider the change in circulation along a line that always contains the same particles. We have

$$(89)\qquad \frac{d\phi_{AB}}{dt}=\frac{d}{dt}\int_A^B(udx+vdy+wdz)$$
$$=\int_A^B\left\{\frac{du}{dt}dx+u\frac{d}{dt}(dx)+\frac{dv}{dt}dy+v\frac{d}{dt}(dy)+\frac{dw}{dt}dz+w\frac{d}{dt}(dz)\right\}.$$

Now consider an element ds which at a time later by dt has moved to a position ds', Fig. 16. Since one end has moved in the X-direction a distance udt and the other a distance

$$\left\{u+\frac{\partial u}{\partial x}dx+\frac{\partial u}{\partial y}dy+\frac{\partial u}{\partial z}dz\right\}dt$$

the new value of its X-projection is

$$dx'=x+dx+\left\{u+\frac{\partial u}{\partial x}dx+\frac{\partial u}{\partial y}dy+\frac{\partial u}{\partial z}dz\right\}dt-(x+udt),$$

from which we obtain the derivatives

$$(90)\qquad \begin{aligned} \frac{d}{dt}(dx)&=\frac{dx'-dx}{dt}=\frac{\partial u}{\partial x}dx+\frac{\partial u}{\partial y}dy+\frac{\partial u}{\partial z}dz,\\ \frac{d}{dt}(dy)&=\frac{dy'-dy}{dt}=\frac{\partial v}{\partial x}dx+\frac{\partial v}{\partial y}dy+\frac{\partial v}{\partial z}dz,\\ \frac{d}{dt}(dz)&=\frac{dz'-dz}{dt}=\frac{\partial w}{\partial x}dx+\frac{\partial w}{\partial y}dy+\frac{\partial w}{\partial z}dz. \end{aligned}$$

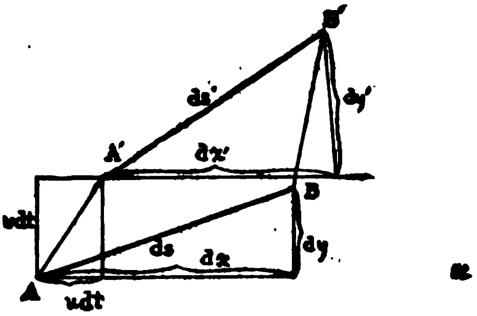


FIG. 16.

But the equations of motion (67) are, in abbreviated form,

$$(91)\qquad \frac{du}{dt}=\frac{\partial(U+q^2/2)}{\partial x},\quad \frac{dv}{dt}=\frac{\partial(U+q^2/2)}{\partial y},\quad \frac{dw}{dt}=\frac{\partial(U+q^2/2)}{\partial z},$$

where $U=-(V+P+q^2/2)$. Accordingly

$$(92)\qquad \frac{d\phi_{AB}}{dt}=\int_A\left\{\frac{\partial(U+q^2/z)}{\partial x}dx+\frac{\partial(U+q^2/z)}{\partial y}dy+\frac{\partial(U+q^2/z)}{\partial z}dz+\left(u\frac{\partial u}{\partial x}+v\frac{\partial v}{\partial x}+w\frac{\partial w}{\partial x}\right)dx+\left(u\frac{\partial u}{\partial y}+v\frac{\partial v}{\partial y}+w\frac{\partial w}{\partial y}\right)dy+\left(u\frac{\partial u}{\partial z}+v\frac{\partial v}{\partial z}+w\frac{\partial w}{\partial z}\right)dz\right\}$$
$$=\int_A^B\frac{\partial(U+q^2)}{\partial x}dx+\frac{\partial(U+q^2)}{\partial y}dy+\frac{\partial(U+q^2)}{\partial z}dz,$$
$$=(U+q^2)\int_A^B,$$

which vanishes for a closed curve. Therefore if the bodily forces are conservative, the circulation around any closed curve moving with the fluid is independent of the time. If the circulation around a closed path is zero at one time, it remains zero, so that if the velocity-potential once exists, it always exists. This theorem is due to Lagrange.

From the equations (69), whose right-hand members are derivatives of the same quantity U, this quantity may be eliminated by differentiation. Differentiating the last equation by y, the second by z, and subtracting,

$$\frac{1}{2}\frac{\partial}{\partial t}\left(\frac{\partial w}{\partial y}-\frac{\partial v}{\partial z}\right)+\xi\frac{\partial v}{\partial y}+v\frac{\partial\xi}{\partial y}-\eta\frac{\partial u}{\partial y}-u\frac{\partial\eta}{\partial y}-\zeta\frac{\partial u}{\partial z}-u\frac{\partial\zeta}{\partial z}+\xi\frac{\partial w}{\partial z}+w\frac{\partial\xi}{\partial z}=0,$$

or otherwise,

$$(93)\quad \frac{\partial\xi}{\partial t}+u\frac{\partial\xi}{\partial x}+v\frac{\partial\xi}{\partial y}+w\frac{\partial\xi}{\partial z}=u\left\{\frac{\partial\xi}{\partial x}+\frac{\partial\eta}{\partial y}+\frac{\partial\zeta}{\partial z}\right\}$$
$$-\xi\left\{\frac{\partial u}{\partial x}+\frac{\partial v}{\partial y}+\frac{\partial w}{\partial z}\right\}+\xi\frac{\partial u}{\partial x}+\eta\frac{\partial u}{\partial y}+\zeta\frac{\partial u}{\partial z}.$$

On the right the coefficient of u, being the divergence of the vorticity, is zero, while that of ξ is by the equation of continuity equal to $\frac{1}{\rho}\frac{d\rho}{dt}$, so that equation (93) becomes

$$\frac{d\xi}{dt}=\frac{\xi}{\rho}\frac{d\rho}{dt}+\xi\frac{\partial u}{\partial x}+\eta\frac{\partial u}{\partial y}+\zeta\frac{\partial u}{\partial z},$$

which may be written, with its two companions,

$$(94)\quad \frac{d}{dt}\left(\frac{\xi}{\rho}\right)=\frac{\xi}{\rho}\frac{\partial u}{\partial x}+\frac{\eta}{\rho}\frac{\partial u}{\partial y}+\frac{\zeta}{\rho}\frac{\partial u}{\partial z},$$
$$\frac{d}{dt}\left(\frac{\eta}{\rho}\right)=\frac{\xi}{\rho}\frac{\partial v}{\partial x}+\frac{\eta}{\rho}\frac{\partial v}{\partial y}+\frac{\zeta}{\rho}\frac{\partial v}{\partial z},$$
$$\frac{d}{dt}\left(\frac{\zeta}{\rho}\right)=\frac{\xi}{\rho}\frac{\partial w}{\partial x}+\frac{\eta}{\rho}\frac{\partial w}{\partial y}+\frac{\zeta}{\rho}\frac{\partial w}{\partial z}.$$

Thus the time derivatives of $\frac{\xi}{\rho}, \frac{\eta}{\rho}, \frac{\zeta}{\rho}$ for a given particle are homogeneous linear functions of those quantities. By continued differentiation with respect to t and the substitution of the derivatives from these equations, we see that *all* the time-derivatives are homogeneous linear functions of the quantities themselves. Thus if at any time these quantities are zero, all their derivatives are zero, and developing by Taylor's theorem, we find that the function remains zero for all times. Thus if a particle is once not vortically revolving, it never can acquire such rotation under conservative forces.

Let us now consider two points A and B lying on the same vortex-line at a distance apart $ds=\varepsilon\frac{\omega}{\rho}$, where ε is a small constant. Since the particles lie on the vortex-line we have

$$(95)\quad \frac{dx}{\xi}=\frac{dy}{\eta}=\frac{dz}{\zeta}=\frac{ds}{\omega}=\frac{\varepsilon}{\rho}.$$

For the difference of velocity at A and B we have

$$(96)\quad u_B-u_A=\frac{\partial u}{\partial x}dx+\frac{\partial u}{\partial y}dy+\frac{\partial u}{\partial z}dz$$
$$=\varepsilon\left\{\frac{\xi}{\rho}\frac{\partial u}{\partial x}+\frac{\eta}{\rho}\frac{\partial u}{\partial y}+\frac{\zeta}{\rho}\frac{\partial u}{\partial z}\right\},$$

or, by equations (94),

$$(97)\quad u_B-u_A=\varepsilon\frac{d}{dt}\left(\frac{\xi}{\rho}\right).$$

Now at an instant later by dt, when the particles are at A' and B'

$$dx'=dx+(u_B-u_A)dt=\varepsilon\left[\frac{\xi}{\rho}+\frac{d}{dt}\left(\frac{\xi}{\rho}\right)dt\right],$$
$$(98)\quad dy'=dy+(v_B-v_A)dt=\varepsilon\left[\frac{\eta}{\rho}+\frac{d}{dt}\left(\frac{\eta}{\rho}\right)dt\right],$$
$$dz'=dz+(w_B-w_A)dt=\varepsilon\left[\frac{\zeta}{\rho}+\frac{d}{dt}\left(\frac{\zeta}{\rho}\right)dt\right].$$

Therefore the projections of the arc ds' in the new position are proportional to the new values of the components of ω/ρ, as they originally were, so that the particles still lie on a vortex-line. Accordingly a vortex-line is always composed of the same particles of fluid. Also, since the components of ds have changed so as to be always proportional to the components of ω/ρ, if the liquid is incompressible the rotation is proportional to the distance between the particles. And whether ρ vary or not, if S is the cross-section of a vortex-filament, since the mass ρSds of a length ds remains constant, so does $S\omega$, the strength of the filament. Accordingly the strength of a vortex-filament is constant, not only at all points in the filament, but at all times, consequently a vortex existing in a perfect fluid is indestructible, however it may move. It is from this remarkable property of vortices discovered by Helmholtz that Lord Kelvin was led to imagine atoms as consisting of vortices in a perfect fluid.

From the kinematical properties of flow due to vortex-motion (62), we see that the velocity at every point of a circular vortex-ring, Fig. 17, due to all the elements of the vortex, is in the same direction perpendicular to the plane of the ring, and in the direction in which the inside of the ring is turning; the ring therefore advances with a constant velocity, as if it were rolling in a tube which it just fits. We may verify this by an experiment due to Professor Tait, where smoke is suddenly forced out through a circular hole in a box provided with an elastic back. The smoky air rolling on the edge of the hole is endowed (by the friction, a *non-conservative* force) with a vortical rotation, and issues as a vortex-ring, which advances with approximately constant velocity for a considerable distance. That it consists always of the same air is seen by the smoke which it carries with it. Such a ring, on striking an edge or obstacle, is not destroyed or cut. Similar experiments can be performed with the rings formed by letting drops of ink fall into water. The loss of velocity finally obtaining in all these cases is due to the viscosity, that is, to non-conservative forces. The treatment of viscosity is beyond the scope of this article.

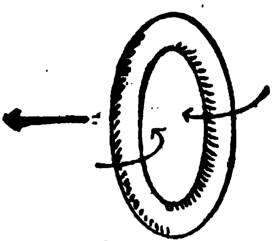


FIG. 17.

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HYDROFLUORIC ACID. See FLUORINE.

HYDROFLUOSILICIC (hī″drō-floo″ō-sĭ-lĭs′ĭk) **ACID.** See FLUORINE.

HYDROGEN (Greek, "producing water," in reference to the fact that in burning in air or oxygen, hydrogen forms water-vapor), a gaseous element, discovered by Cavendish in 1766. It was at first called "inflammable air," the present name being due to Lavoisier. Hydrogen is the lightest known substance, and it also has the smallest known atomic weight. The atomic weight of hydrogen is often taken as unity in stating the relative atomic weights of the different elements (see Atomic Theory), but it is now more usual to assume the atomic weight of oxygen to be precisely 16, which amounts to making the atomic weight of hydrogen 1.0076. According to Regnault's experiments, hydrogen has a density equal to 0.06926 of that of an equal volume of air, at the same temperature and pressure. In absolute measure, the mass of a cubic centimetre of hydrogen, at the freezing point of water and under a pressure of 76 centimetres of mercury at Paris, is 0.00008957 gram, or 0.08957 milligram. Hydrogen has the chemical symbol H, and is one of the most abundant elements known. It occurs in the free state in volcanic gases, and in the sun and in many of the fixed stars. Free hydrogen is also present in the earth's atmosphere in exceedingly small amount. Water (or hydrogen monoxide) is its commonest and most abundant compound, and it is an essential constituent of nearly all organic tissues. Hydrogen may be prepared very easily by many methods. One of the most convenient of these consists in acting upon metallic zinc with dilute sulphuric acid, the reaction in this case being: $Zn + H_2SO_4 = ZnSO_4 + 2H$. Hydrogen is chemically inert toward most of the elements, at ordinary temperatures, but it combines with chlorine when exposed to light,— quietly in diffused daylight, and explosively under the direct action of sunlight. At elevated temperatures it combines with other elements also, and it burns in air (or oxygen) with the development of an intense heat, but with very little light; water being produced as the result of the combustion. Hydrogen has been both liquefied and solidified. Its critical temperature is estimated, by Dewar, to be about 402° F. below zero, and the same authority gives 15 atmospheres as the critical pressure. See Critical Point, and Gases, Liquefaction of.

Hydrogen combines with oxygen in two proportions. The monoxide, or common water, H_2O, is formed, as already noted, when hydrogen is burned in air or in oxygen. It is also formed in many of the double decompositions that occur in chemistry, as when metallic oxides or hydrates are dissolved in acids. Sodium hydrate, for example, combines with sulphuric acid according to the equation $2NaOH + H_2SO_4 = Na_2SO_4 + 2H_2O$, sodium sulphate and water being formed.

Hydrogen peroxide (or dioxide), H_2O_2, may be prepared by acting upon barium dioxide, BaO_2, with dilute sulphuric acid; the reaction being: $BaO_2 + H_2SO_4 = BaSO_4 + H_2O_2$. The barium sulphate that is formed at the same time is a heavy, insoluble substance, which is easily removed from the solution by filtration, or by settling and subsequent decantation. The aqueous solution of the peroxide may then be concentrated by evaporation over strong sulphuric acid, under the receiver of an air pump. When the water has all evaporated, the pure peroxide remaining behind has a specific gravity of 1.452, and is a colorless, oily liquid, devoid of odor, but having a disagreeable metallic taste. The peroxide does not freeze, even when cooled to 0° F. At 70° F. it slowly gives off half its oxygen, passing into water. At 212° F. this change takes place very rapidly. Owing to the facility with which hydrogen peroxide gives off oxygen, it is used quite largely as a bleaching agent, and also, in surgery, as a disinfectant in the treatment of wounds.

When hydrogen is passed through boiling sulphur, combination takes place, with the formation of hydrogen sulphide, or sulphuretted hydrogen, H_2S. This compound is more conveniently prepared, however, by treating sulphide of iron, FeS, with dilute sulphuric acid, ferrous sulphate ($FeSO_4$) being formed at the same time. The reaction is: $FeS + H_2SO_4 = FeSO_4 + H_2S$. Sulphuretted hydrogen is a gas, devoid of color, but possessing an overpowering odor, suggestive of rotten eggs. It burns with a bluish flame and is poisonous when inhaled in any considerable quantity, even though largely diluted with air. Under ordinary atmospheric pressure, sulphuretted hydrogen gas condenses, at 80° F. below zero, to a colorless liquid, which freezes to an ice-like solid upon being further cooled to 121° F. below zero. Liquefaction may also be induced at the ordinary temperature of the air by the application of a pressure of from 17 to 20 atmospheres. Sulphuretted hydrogen is an invaluable reagent in the chemical laboratory, where it is greatly used for separating the metals into groups, in inorganic analysis. See Chemical Analysis.

With carbon, hydrogen forms a large number of compounds which are collectively known as hydrocarbons (q.v.). With carbon and oxygen, and with carbon, oxygen and nitrogen, hydrogen forms compounds past enumeration. For further information concerning these, consult any treatise on organic chemistry, and also, in this encyclopædia, the articles Compressed Gases; Fatty Compounds; and Aromatic Compounds.

HYDROGEN AND OXYGEN, Electrolysis of. See Electrochemical Industries.

HYDROGEN PEROXIDE, HYDROGEN SULPHIDE, etc. See Hydrogen.

HYDROGRAPHIC OFFICE, United States, an institution established by Act of Congress in 1866 for the improvement of the means for navigating safely the vessels of the navy and mercantile marine. It is attached to the Bureau of Navigation of the Department of the Navy, and prepares the instructions for and receives the results of the ocean and coast surveys which the naval service is authorized to perform. The accumulations of this office, in the form of charts, sailing directions, and nautical tables for the use of mariners in the practice of navigation and nautical astronomy, have resulted from original naval surveys, from geographical and cartographical data gathered from the reports of commanding officers of vessels in the general naval service, from information collected from mariners of all nationalities by the branch hydrographic offices operating in sixteen of the principal ports of the United States, and from the hydrographical information that comes into the custody of the Department of the Navy through the prosecution of surveys by foreign governments. These publications relate to all parts of the navigable waters of the globe and form an important asset in the operation of American shipping.

At regular intervals there have also been constructed world-charts showing the lines of equal declination and inclination of the magnetic needle and the intensity of the earth's magnetic force, which have been supplemented by publications of the results of the analytical treatment and the discussion of magnetic observations made at a great number of places in all parts of the world, and also charts showing the telegraphic connections of the world, and showing the tracks for full-powered steamers with the shortest distances in nautical miles. These charts, as well as those issued for purely navigational purposes, are, in nearly all cases, constructed upon the Mercator projection. The exceptions include the circumpolar charts showing the frigid zones and the great circle sailing charts of the several oceans.

A pamphlet of notices to mariners is issued each week, giving information to enable mariners to amend the publications that are extant from the hydrographic office, by means of descriptions of newly discovered dangers to navigation and recently installed or altered lights, beacons and buoys.

The opportunities that surround the seafarer for observing the processes of nature have been made of avail by the hydrographic office in collecting observations in relation to the physical geography of the sea, which, when collated and digested, are of benefit to the material interests of commerce and navigation. For such a field observers are necessary in numbers that come only at the call of nations; and, in order that no man may feel that he has labored in vain, it is necessary to give back to each, to his own profit, the results of the united experience of all. This is the purpose of the pilot charts — to give timely expression, in a graphical form easily comprehended by navigators, of those conditions and facts of experience which, on being taken account of in navigation, will tend to safeguard the lives of seamen and accelerate transit from place to place. These charts are published monthly for the North Atlantic, Indian, and North Pacific oceans, and at quarter-yearly intervals for the South Atlantic and South Pacific oceans. They show the regions of storm, fog and floating masses of ice, the set and rate of ocean currents, the average direction and force of the winds to be expected, the trade-wind limits, the best passage routes, the normal isobaric and isothermal lines over the ocean, the variation of the compass and its change with time and locality, and the positions in which derelict vessels and floating obstructions to navigation are reported to exist.

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HYDROGRAPHIC SURVEYING. See Surveying.

HYDROGRAPHY. Hydrography has been viewed by past generations of writers as comprehending all those branches of science which pertain to the waters of the earth's surface. In the present generation, however, the description and knowledge of the oceans is embraced in oceanography; the description of the river systems, their function as agents for the sculpture of the land, and the conditions under which their courses are modified, and the description of the lakes, and the processes of their creation and extinction are viewed as subjects of physical geography.; the treatment of rivers from the point of view of their manner of flow, their floods, and their employment as sources of power is designated as river hydraulics; and the motions and oscillations of lakes and other bodies of fresh water, including their physical, chemical, meteorological and biological description, constitute the science of limnology. Hydrography, in its definite application, comprehends those operations and investigations which relate to the representation and charting of the depths, shoals and shore lines of oceans, lakes, rivers,. harbors and other bodies of water, mainly in the interests of navigation and for the purpose of indicating the hidden dangers to be avoided and the channels where safety is to be sought in the guidance of shipping. It is not only necessary to designate the exact position and extent of dangers to navigation, but also to indicate the undulations and characteristics of the bottom which, being charted, frequently enable the navigator, by casts of the lead or sounding-plummet, to recognize his position, or the course he is following, and which, at night, are often the only guides to an anchorage.

History.— There came a time in the history of the world when commerce was pushed into the sea. There was an age in which, by two world-old high roads stretching across Persia, the slow caravans passed and repassed bearing silks and spices and merchandise from Central Asia and India to Syria and the West. Then came the sweeping hordes from the northeast to interpose a barbaric wedge which practically shut the main gates of the Eastern trade; and Europe began to find the way to India and China in ships. Long before the rise of Greek civilization, and long before the oldest Greek and Hebrew records, Phœnician navigators, having emigrated from the shores of the Erythræan Sea or Indian Ocean, were making voyages over the Mediterranean Sea and through the Pillars of Hercules or the Strait of Gibraltar into the Atlantic Ocean. And, after the Phœnicians, the Carthagenians, animated by the same spirit of commercial enterprise, continued to conduct voyages which might rival those of much later centuries. These experiences must necessarily have produced some knowledge of the configuration of the coasts with which the Phœnicians and Carthagenians were familiar and of the depths of the bordering waters, but this knowledge, whatever its extent, was not transmitted to us, and it remained to later centuries to provide those foundations of knowledge upon which the superstructure of hydrography has been raised.

Although the Greeks must be regarded as the founders of scientific geography, they are not known to have undertaken voyages of discovery before the 4th century B.C., when they sent an expedition to the North Sea under the direction of the illustrious astronomer and mathematician, Pytheas, who, at that distant period, had determined the latitude of Marseilles with such exactitude that 20 centuries afterward Gassendi found it correct to within a few seconds. There is no doubt that, before this voyage, the chart of the seas to the west of Europe was almost a blank, and that, down to the time of Strabo, it retained the form given to it by Pytheas. Hydrography is also indebted to the solicitude shown for the sciences by the Ptolemies, the successors of Alexander in Egypt. Timosthenes, a native of Phodes, who was admiral of the Egyptian fleet under Ptolemy Philadelphus, drew up a treatise «Concerning Ports» which may be regarded as the precursor of the modern sailing directions issued by the hydrographic offices of the maritime nations. Although the Romans carried their arms throughout nearly all the world known to the ancients, including in their rule a great extent of coast bordering on the Atlantic, they never organized any voyages of discovery into this outer sea, after the manner of the Carthagenians and Greeks.. It was near the beginning of the Christian era when the celebrated Grecian geographer, Strabo, suggested that besides the world known to the Greeks and Romans, other continents or other worlds might yet be discovered inhabited by different races of men. Strabo does not appear to have been acquainted with Hippalus, an Egyptian navigator, living about the same time, who proved the regular alternations in the direction of the monsoons of the Indian Ocean, and profited by the discovery to open up a route across the high seas between the shores of the Red Sea and India. Coast routes, followed up to this time, were abandoned, and a fresh impetus was given to voyages in oriental waters. Nevertheless, 150 years afterward, Ptolemy, whose great authority gave his views a scientific stamp, rejected the hypothesis of an ocean extending to the east of the Asiatic continent and regarded these great land masses as extending indefinitely toward the north and east. His maps, in which he accomplished so great an advance in projection by latitude and longitude, show also that he shared the view of many of his predecessors in representing the Indian Ocean as a sea enclosed by an extension of Africa eastward to China. This Southern Ethiopia remained on maps down to the time of the second voyage of Captain Cook. Two principal views prevailed among the ancients regarding the distribution of coasts and seas. The school that may be called Homeric — to which Eratosthenes and Strabo belonged — considered the three continents of the Old World as forming a single island surrounded by the ocean. On the other hand, the adherents of what may be called the Ptolemaic school — to which Hipparchus belonged — did not admit the extension of the sea around the known world. They considered the Atlantic and Indian oceans to be great enclosed seas like the Mediterranean; they held that the extreme points of the known lands toward the east and the west approached so nearly to each other that a ship, parting from the west, might easily reach the eastern extremity, which they regarded as greatly extended. This error was perpetuated, thanks to the influence of Ptolemy, and led directly, 14 centuries afterward, to the discovery of the New World by Columbus. When the barbarians invaded and overran Europe in the 4th and 5th centuries, the maps and other scientific works of ancient civilization were destroyed or lost sight of for centuries afterward. In the Middle Ages, the Arabs extended their voyages as far as China in the East, and, in the West, they were acquainted with the whole of southern Europe and of northern Africa. It is to their intercourse in the 10th and 11th centuries that the knowledge leading to the introduction of the mariner's compass is believed to have been conveyed from China to Europe. The ancients, who made so many excellent circumnavigations of the Mediterranean, never constructed general or coast charts. The marine compass-charts of the Middle Ages therefore demonstrate a great progress in knowledge in relation to coast charts which were based on rounds of angles taken from successive positions by means of the compass. The compass-charts, or *portulani,* a name applied both to the charts and the accompanying sailing directions, made their appearance in Italy in the 13th century. The most remarkable of these compass-charts is known as the Catalan chart. It is a map of the world in six sheets, dated 1375, and is at once a planisphere and a marine chart. It indicates in particular the new islands discovered in the Atlantic Ocean, and shows much progress in the representation of the Indian Seas. It is on this chart that India appears for the first time as a peninsula, and the Indian Ocean is no longer an inclosed sea as had been previously represented.

The compass shows the mariner his course, but not how far he may have been drifted from it by wind or current. It is the province of nautical astronomy to tell him from time to time his exact position by latitude and longitude. Nautical astronomy was greatly advanced by Prince Henry the Navigator, a prince of Portugal, who founded an observatory and school at Sagres in 1420, employed the best Italian mapmakers and pilots, and inspired the heroic age of Portuguese and Spanish exploration, which took its course toward the Atlantic because Europe, whose face was turned toward Asia up to the time of the closing of the routes to the East through the capture of Consantinople by the Turks in 1453, now began to transfer the centre of her civilization and commercial activity to the Great Western Ocean. The great works of the ancient geographers were rescued from the expiring Byzantine Empire and reproduced in the West, and, after the lapse of a thousand years, maps were once more constructed on the principles of latitude and longitude initiated by Ptolemy. It was into such a state of the progress of knowledge of the coasts of the world that the generation of Columbus, Gama, and Magellan was introduced — the generation that gave America, the route to India, and the circumnavigation of the globe. The revolution that had been effected in the map of the world between the sailing of Columbus and the year 1600 may be realized by comparison of Behaim's famous globe of 1492 — the year of the sailing of Columbus — with Hakluyt's map of 1599. Behaim's globe had no America, and the Indian Ocean was inclosed to the south by an eastern extension of South Africa: it was essentially the same as Ptolemy's of 13 centuries earlier. But, Hakluyt's map, a century later, shows the modern world, except for the omission of Australia which had only recently been reached by the Dutch in those voyages from their East Indies' colonies as a result of which its western coast was explored and represented in the map by Ortelius, in 1570, as New Holland.

In the 16th century the art of drawing up sea charts found its greatest cultivation among the Spaniards and Portuguese. The governments of Spain and Portugal endeavored to have charts constructed with the greatest possible accuracy. Portugal created a commission, of which Martin Behaim was a member, for the greater development of this science. In Spain, Amerigo Vespucci was appointed Chief Pilot in 1508, and soon became the head of a hydrographic bureau for the execution of charts and kindred purposes. It was ordered at this time "that henceforth all navigators sailing towards known or unknown parts of India, who should discover new regions, islands, harbors or bays, affording some interest for the general chart, should, on their return to Europe, report the same to the Chief Pilot." Such was the importance attached to the proper construction of these charts, that foreigners were summoned to correct or complete these documents. It was for this purpose that the celebrated English navigator, Sebastian Cabot, repaired to Spain in 1512.

In the course of his voyages, Cabot carefully observed the changes in the variation of the compass, and he was instrumental in bringing it to pass that, after the early part of the 16th century, care was taken to introduce this datum when drawing charts. Charts were further improved toward the middle of the 16th century by the use of the Mercator projection, which has rendered signal services to navigation, and by a more accurate outline of the sea coasts and a more precise representation of the position of each of the points: the progress thus made was in direct relation to the improvement of the methods of determining latitude and longitude, and the improvement of nautical instruments. The soundings which could be ascertained with the appliances then in existence soon were noted in charts at important points of the coasts, and hydrographic signs, resembling those at present in use, began to be employed to show reefs and rocky bottom by means of crosses, and sand banks and shallows by means of masses of dots. The period which opens with the voyages of Captain Cook, in the second half of the 18th century, marks the beginning of the more precise observations in hydrography. After these voyages, the chart of the Pacific, until then almost a blank, differed but little from that of the present, in general superficial outlines; and the reduction of Australia approximately to the proportions now accepted, and its separation from New Zealand and from the *Terra Australis Incognita* were among his great achievements. It was reserved to the United States Exploring Expedition under Charles Wilkes to discover the Antarctic Continent in the first days of the year 1840, and to chart 1,500 miles of its coastline; and also to contribute extensively to the records of geography and terrestrial physics with which the splendid set of sea voyages by our own and all other maritime countries have stocked the hydrographic offices established by the various nations during the last one hundred years or so.

By the labors of these institutions, new details have been introduced for determining position, based upon astronomical and geodetic observations; the survey of coastlines is no longer made by the compass, but by trigonometrical measurement; the meteorological element is introduced in the graphical representation of the seas, hydrographic signs guide the seaman, reliable soundings inform him of the depth of water in the approach to nearly every coast, the currents are delineated, and the local tides are indicated.

Modern Practice.— The two branches of surveying on which hydrography is most dependent, and which it is most convenient to have precede it, and on which its accuracy largely depends, are triangulation and topography. The triangulation fixes the position of the trigonometrical points on land by means of which the location of the soundings is determined. The topography provides the delineation of the shore, locates the rocks that show above water, and the limits of dry shores and banks. These data are placed in their proper relative position on an outline map whose scale will depend upon the minuteness with which the submerged features are to be mapped, and this in turn will largely depend upon the characteristics of the area and its importance to navigation or other commercial purpose. A scale of 1–10,000 (which means that 10,000 feet on the surface of the earth are represented by one foot on the projection) is well adapted for the survey of most harbors. The points determined by triangulation are plotted on the outline map or projection in their proper geographic positions. These points consist of prominent objects, such as church spires, chimneys, conspicuous rocks or trees and specially built signals, all of which are of a suitable kind to be observed from a boat or vessel while sounding. When a sufficient number of these signals or other objects have been located and a tide gauge or tide staff has been erected at some suitable point in the vicinity of the work, the next step in the hydrographic survey is making the soundings for the depth of water. Power launches and ships are now more often used than rowboats in running sounding lines. The lines of soundings are run in accordance with such a plan as will best develop the contour of the bottom and its characteristic features; generally a rectangular system of lines is used, and where the two systems of lines cross each other the soundings must agree within prescribed limits varying with the depth of water. When beginning a line of soundings, two observers, with sextant in hand, the recorder, with a watch or clock and record book, and the leadsman, with his sounding line, take their respective positions. The observers measure with their sextants the two angles between three shore signals and read the angles measured; the leadsman gets a cast of the lead and announces the depth of water in feet or fathoms and feet, and the recorder records all these with the time the boat begins to move. The boat does not stop again until the end of the line is reached. The position of the boat is determined by the observation of pairs of angles at equal intervals of time (two to four minutes), or when there is a change in the direction of the line, or a change of speed of the boat or sudden change in depth of water, and at the end of the line. Where the depths are changing rapidly the soundings are taken by the leadsman as frequently as possible, and the time of each sounding may be noted to seconds; but where the bottom is comparatively level the soundings are preferably taken at equal intervals of time. The pairs of angles taken for position of the sounding boat are plotted on the projection or outline map by means of a three-arm protractor, thus each sounding is laid down in its proper position. When practicable the lines of soundings are run on ranges — that is, with the boat in the same straight line with two fixed objects on shore.

While the boat has been running the lines of soundings, the water has not remained at the same level owing to the rise or fall of the tide, and, therefore, the tides must be observed by means of a staff or self-registering tide gauge while the sounding is in progress, so that the depths can be reduced to a common plane of reference. Each sounding must therefore be corrected for the stage of the tide at the time it was taken. The plane of reference usually adopted is that of "mean low water," which is, roughly speaking, the mean reading of all the low waters observed on the tide staff for as long a period as practicable, but usually not less than one lunar month. The reading of mean low water on the tide staff being known and the observations of the height of the tide having been made at sufficiently frequent intervals while the soundings were in progress, the tidal corrections may be readily applied to the measured soundings. In order to preserve the plane of reference permanent tidal bench marks are established on shore and the plane of reference is referred to them by leveling. In deep-sea sounding, offshore it is not necessary to apply the tidal reduction to the soundings.

The successive positions of the sounding boat being plotted, and the number and time intervals of the soundings being shown in the record, intermediate soundings are spaced accordingly between the positions. The result is practically the same as though the boat's position had been instrumentally ascertained at each sounding. Up to depths of about 20 fathoms the soundings can readily be made by the hand line; for greater depths machine sounding appliances are used. Down to about 85 fathoms, these appliances are designed to be used while the sounding vessel is under way; at greater depths, including deepsea work, the vessel is stopped while the sounding is made. When sounding in the deep offshore waters, piano wire is used on the drum of the sounding machine, and spherical or pear-shaped shot weighing about 60 pounds is used as a sinker and is attached to the wire by a device which automatically detaches it on reaching the bottom. The wire is then reeled in by means of the reeling engine and a new sinker attached for the next sounding. The depth of water is measured by noting the length of wire run out, and, as a check, this is again noted in reeling in. In addition to ascertaining the depth of the ocean, a mechanical device is also attached to the end of the sounding wire by means of which a specimen of the materials of the ocean bottom is secured and brought up in deep-sea sounding. While the vessel remains in sight of land the method of determining position in running the sounding line is similar to that explained in relation to sounding boats and launches in inshore and harbor hydrography, but when out of sight of land the position is obtained by radio-direction plotting or by astronomical observations and dead reckoning.

Hydrographic surveys with the lead line, while developing the slopes of the bottom, do not with certainty reveal all of the hidden dangers to navigation that lie in the pathway of ships. In regions like the coast of Maine and in Alaska, where there are isolated rocks and ledges on the bottom, or in the tropical regions fringed with coral reefs and dotted with coral heads, the work must be supplemented by examination with special appliances. Owing to the extension of commerce and its increasing demands, bringing into use ever larger and deeper draft vessels, much special examination is now required. To meet these requirements and in order to be certain that an area is free of obstructions to navigation to a specified depth, the water area is swept over by an appliance known as a wire drag, which is essentially a large wire rope (lengths up to 12,000 feet have been used), supported at intervals by specially designed buoys so arranged that the wire can be maintained at any required depth irrespective of the changes in the stage of the tide. This apparatus is towed through the water by two or three launches, and, if no obstruction is encountered, it is certain that no dangers exist at a less depth of water than that at which the drag was set. One of the best features of the wire drag is the rapidity with which an area can be examined. The length of drag now commonly used is 3,000 feet or over, except when used in channels of less width than this. The average speed of the drag through the water is about a mile and a half per hour, and the area that can be covered in a day depends largely upon local conditions, such as natural or artificial obstructions. Great accuracy is required of the hydrographer, even where the water is so deep that there is no possible danger of the largest ship afloat touching bottom, because the hydrography shown on a mariner's chart has a twofold object: First, to point out to the navigator the invisible dangers which he must avoid; and second, to reveal the configuration of the bottom and also its physical characteristics so truly that by the use of his sounding appliances he may fix his position in relation to those dangers, or, when offshore or the coast line is invisible, determine his distance from land.

Marine hydrography also embraces the observation and reduction of the tides and the tidal currents. Tidal phenomena present themselves to the observer under two aspects — as an alternate rising and falling of the surface of the sea and as a recurrent inflow and outflow of the waters. In common and general usage, the name tide is applied both to the vertical and the horizontal movements, but, in the strict sense, its meaning is confined to the changes of elevation, while the recurrent streams are properly distinguished as tidal currents. While the rise or fall of the tide in a given period may be practically uniform in amount and nearly simultaneous at widely separated points within an extensive area, the currents which accompany the change will vary widely within the same region, being modified by every outline of the shore and by every irregularity of the bottom. Moreover, the time at which the tidal current changes its direction, as from flood to ebb, or the reverse, does not generally coincide with the time at which the tide begins to fall or to rise.

The basis of fact derived from the observation of the tides in hydrographic surveying provides for the prediction of their occurrence, and, accordingly, on account of the vital importance of tidal knowledge in navigation, the United States issues an annual volume of tide tables in which the predicted times and heights of every high and low tide throughout the year are stated for 70 of the principal parts of the world, along with provision, by means of tidal differences, for affording like information in relation to more than 3,000 other ports in all parts of the world. See NAVIGATION.

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HYDROID, a class of cœlenterate animals. See HYDROZOA.

HYDROLITE. See GMELINITE.

HYDROLOGY, hī-drŏl'-o-gē. Although etymologically hydrology covers the entire science of water, its properties, phenomena, laws and distribution, the application of the term usually is restricted to investigation and description of water in or on the earth, that is, underground waters and stream flow or the increment of water from rainfall. Water that comes to the earth from the atmosphere in the form of rain or snow is in large part gathered into streams or lakes while a smaller part passes underground. Some of it evaporates so rapidly that it does not add to the increment and there is also considerable loss by evaporation from all water bodies and from ground water brought to the surface by vegetation and capillary action. Many factors influence the volume and movement of surface waters and the passage of waters underground. Stream flow depends on conditions of precipitation, light showers often yielding no flow and heavy storms resulting in floods. The most important factors are climate, vegetation, topography, the works of man and various geologic conditions, especially those affecting the absorption of surface water by soils and rocks. The passage of water into the ground is controlled by the texture of surface materials and of the rocks below, and in large measure by the configuration of the land and conditions of rainfall or snow melting. Much underground water comes again to the surface in the general seepage on slopes and also in springs which often draw from deep sources, and the water in the ground is depleted by vegetation and capillary action. The science of underground water is sometimes designated hydrogeology because it is a branch of geology. Extensive investigations of underground waters have been made by geologists in various parts of the world with most important economic results. The basis of the work is geologic because the water is mostly contained in sand, sandstones and various other rocks which occur in succession among the strata constituting the earth's crust. The water-bearing beds are carried to great depths by downward dips of monoclines or basins. Locally they are cut by faults and igneous masses and generally they are affected by variations in texture both of themselves and of adjoining strata. The «head» controlled by height of intake is an important factor in delimiting the area in which artesian flows may be expected. Mineral or saline components affect the quality of the water and variations in texture and thickness of the beds control the volume of water available. The study of most problems of hydrology relating to artesian water and their prospects require the determination of geologic conditions in wide areas, for the evidence is often many miles away from the place where the water is desired. The rate of movement of water through various rocks and sands and the capacity of these materials for water have been studied extensively by King, Slichter and others. For many years a branch of the United States Geological Survey has been devoted to studies of problems of hydrology. The function of this work is to investigate water supply from wells and streams for domestic use, manufacturing and irrigation and consideration is also given to water powers and methods of pumping and storing water. The determination of volume of water in surface streams is an important branch of hydrology. Ordinarily streams are gaged by current meters taking the velocity on a measured cross section but on many rivers vertical gages are set and observations are made of the height of the water while in some cases water stage recorders are used which give a continuous record. Volume of flow is calculated from these records by a rating table computed from observations made at various stages of flow. The amount of water flowing in a stream, termed the discharge or run off, is expressed either in rate of flow or volume of increment. Rate of flow is given in second feet (cubic feet per second) but some records are given in miner's inches or in second feet per square mile. A miner's inch is the discharge through an orifice one inch square under a head which varies locally and is defined by State laws. In California the miner's inch is .187 gallons a second or .0248 second feet; in Colorado it is .195 gallons or about 5 per cent more. A second foot is 7.48 United States gallons a second, 1.98347 acre-feet a day. One acre-foot is 325,851 United States gallons, (43,560 cubic feet) the amount covering an acre one foot deep. It is equal to 50 miner's inches in Idaho, Kansas, Nebraska, New Mexico, North Dakota and South Dakota, 40 miner's inches in Arizona, California, Montana and Oregon and 38.4 miner's inches in Colorado. A second foot falling 8.81 feet is equal to one horse power. The United States Geological Survey alone and in co-operation with various state surveys maintains many stations, where volume of stream flow is determined as often as may be necessary to indicate the total yearly flow and its variations from year to year. By this means in the last 25 years or more there has been ascertained the amount of water available for various purposes including water power in all the principal streams of the country. Similar observations have been made in Canada for the past 10 years. The methods have been largely developed by engineers in the water resource branch of the United States Geological Survey and they are generally accepted as standard. Records of rainfall such as those systematically obtained by the weather bureau of the United States Department of Agriculture throughout the country afford important hydrologic data, for their averages show the amount of precipitation that may be expected in various areas.

The determination of rates of evaporation throw light on the prospects for water storage. See GEOLOGY; IRRIGATION; PHYSIOGRAPHY; RIVERS; ARTESIAN WELLS.

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HYDROMETAMORPHISM. See METAMORPHISM.

HYDROMETER, an instrument for determining specific gravity, as of fluids, by flotation. For determining the specific gravity of a liquid, the instrument is floated in the liquid itself. When a solid body floats in a liquid, and displaces a quantity of the liquid, it is supported by the same upward pressure that formerly supported the liquid which it displaces. The weight of the solid body is thus equal to the weight of the liquid that it displaces. Hence the depth to which the same solid body is immersed in a liquid is greater as the density of the liquid is greater. This makes it possible to test the strength or purity of various solutions. And, likewise, the weights required to immerse a given body equally deep in various liquids are inversely proportional to the densities of the liquids. On each of these principles a form of hydrometer is founded. One is called the constant weight hydrometer, the other the constant volume hydrometer. The first, usually made of glass, is shown in Fig. 1. It has a large hollow bulb, and below that a smaller bulb, weighted with mercury, to make the instrument float upright and it is surmounted by a cylindrical glass stem which is graduated, the divisions being usually marked on or within the stem. The depth to which the hydrometer sinks in the liquid gives the density.

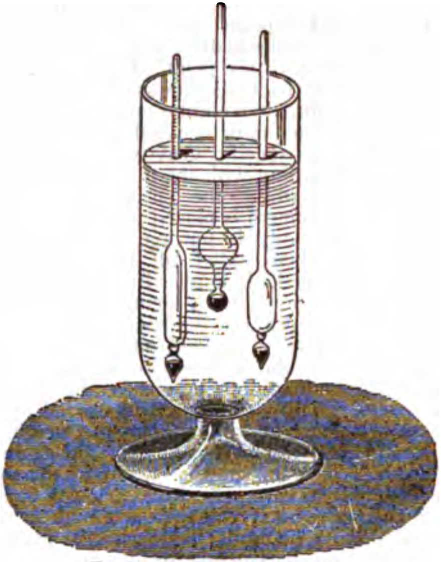

FIG. 1.—Forms of Hydrometer.

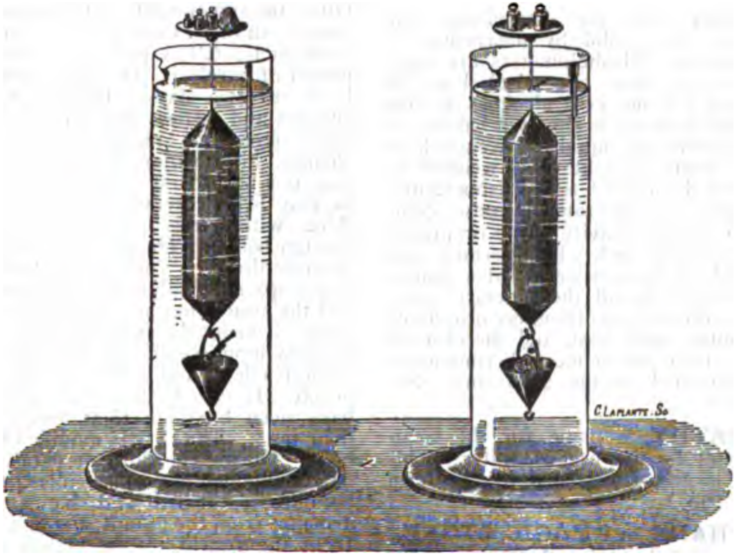

FIG. 2.—Nicholson's Hydrometer.

Of constant volume hydrometers, Nicholson's hydrometer, the best known, possibly, is adapted for determining the specific gravities not only of fluids, but of solids also. It is shown in Fig. 2. It consists of a hollow cylinder of metal, surmounted with a very fine metallic stem, to the top of which there is attached a plate or pan for weights. From the bottom of the metallic cylinder hangs a cup or basket. The whole instrument is weighted so as to float upright. On the fine metallic stem there is a marked point: and by putting weights on the upper pan the hydrometer is always made to sink precisely to the point. If the weight of the instrument itself is known, and also the standard weight, or weight required to sink it to the marked point in distilled water, the calculation of the specific gravity of any liquid from an observation with the instrument is very easy. To determine the specific gravity of solids, the instrument is placed in distilled water and the solid body is put on the upper pan. Weights are then added till the hydrometer sinks to the marked point. But the standard weight of the instrument being known, it is plain that the difference between it and the weights that must be added on the upper pan to the weight of the body whose specific gravity is to be determined must be the weight in air of that body. The body is now transferred to the basket below the instrument, and the weight of the solid in water is similarly determined. From these data the specific gravity of the solid is calculated. Hydrometers are variously named from their use, as areometer, one for determining the density of fluids; lactometer or galactometer, one for measuring the density of milk, and usually having a scale graduated from 1.000 to 1.029; incorrectly called creameter, as it does not correctly measure the cream; sacharometer, one for determining sugar contents; salinometer, one for testing saline solution, as the brine in a marine boiler; urinometer, one for detecting the presence of sugar, etc., in urine; volumeter, one for determining the specific gravity of a solid by measuring its volume in a liquid. Alcoholometers are commonly graduated to show pure alcohol as 200 and proof spirit (50 per cent alcohol) as 100. The chemical hydrometer is simply a balance in which equal volumes of liquid are weighed, or in the case of testing a solid, it is weighed in air and in distilled water of tested temperature. A simpler device for the same purpose, commonly called a specific gravity bottle or pycnometer, is a measuring flask which permits easy comparison with the known weight of a similar measure of water. In all these devices temperature is a modifying condition, because fluids increase in volume with heat, and therefore it is customary to have one or more thermometers permanently attached to the apparatus. See SPECIFIC GRAVITY.

HYDROPATHY, a name for the treatment of diseases by the use of water. This name is now largely superseded by the term hydrotherapy (q.v.).

HYDROPHANE or **«MAGIC STONE,»** a porous dehydrated opal, which is opaque when dry but becomes translucent in water.

HYDROPHILIDÆ, hī'drō-fĭl'ĭ-dī, a family of beetles inhabiting submerged vegetation in stagnant waters. They are of the scavenger variety, the larvæ being carnivorous and the adults feeding on decaying vegetable matter. Some forms are found in moist earth or dung heaps, feeding on lesser animal forms. The body is black and elliptical, with a white sheen on the ventral surface imparted by a film of air which covers it. The antennæ are thick and club-shaped. About 150 species are found in the United States, of which one of the most common is *Hydrophilus triangularus.*

HYDROPHOBIA (from Greek words meaning «fear of water»), an acute or subacute infectious disease, particularly of canine animals. It is usually communicated by a bite of the afflicted animal, and the contagion, the exact nature of which is still under discussion, is resident for the most part in the saliva, although it has been found in the peripheral nerves, the pancreas and the suprarenal gland. It is frequently communicated to man, although the dog, wolf, fox, deer, cat, cow and skunk are the animals most frequently affected; it has been known to occur also in the horse, pig, birds and other animals. Nine-tenths of all the cases are contracted through the bites of rabid dogs. Hydrophobia may be produced, however, by wounds occurring during the dissection of rabid animals; it is said to have been caused by eating the flesh of animals that have died of the disease; and the milk of sucklings, animal and human, is thought to contain the virus. This poison has been found to be active in a dog 44 days buried, and in a rabbit buried 21 days.

In dogs the disease is comparatively common. In 1900 D. E. Salmon, chief of the United States Bureau of Animal Industry, determined that the disease was prevalent throughout the United States, and largely on the increase. The chief symptoms in dogs may be divided into two classes. Dogs suffer from furious rabies, and from dumb rabies. In the former Pasteur thought that the brain was involved; in the latter, the spinal cord. The furious form of the disease shows (1) a period of melancholy or depression; (2) a period of irritation; (3) a period of paralysis. The first varies from a few hours to two days. During this period the anxious and restless dog may also be cross. He hides from his master, obeys sullenly and changes his position frequently. His appetite may not be at first affected, but it soon fails; he may lick everything in sight, or bite everything within reach, swallowing all sorts of foreign bodies. The period of irritation usually persists three or four days, during which the dog is spasmodically mad; restlessness increases, and the animal has an irresistible impulse to run away. During the running spells dogs may bite at everything in sight; at such times they usually seem fearless, and rarely avoid other dogs or people. If caged, they tear and chew on the bars, even breaking their teeth or fracturing their jaws. The bark is modified into a peculiar howl. During the third or paralytic period the dog is subdued and more sullen; the lower jaw becomes paralyzed and hangs down, saliva dripping from the mouth; the gait is staggering; from the fourth to the eighth day after the onset he dies of paralysis or exhaustion.

In dumb rabies the characteristic second stage may be entirely absent. The most persistent feature of dumb rabies is the dropped lower jaw, the paralysis of the jaw in the later stages preventing the dog from biting. Veterinarians see many cases of dumb rabies in dogs brought to them by owners who think that the trouble is caused by a bone in the throat. Beware of a dog that becomes listless and dull and hides away; is always on the go, prowling about and restless; one that is sullen and walks with his head down like a bear. A dog that scrapes incessantly and tears things up, and one that suddenly becomes excessively fond of its master, desiring to lick his hands and face, should be watched and guarded. A dog that has trouble in swallowing, that seems to have a bone in his throat, or, having wandered away from home, returns covered with dirt, exhausted and miserable, should be put under lock and key.

So far as the water-test is concerned, it is nonsense. The mad dog is often very fond of water; he is thirsty and rushes into water, thrusts his head into it; but he may have great difficulty in swallowing it, the act of swallowing usually bringing about severe convulsions.

In man the disease may go through somewhat similar stages, but the course is greatly modified; males are more likely to be affected than females, the difference in dress and exposure accounting for this; and two-fifths of the subjects are below the age of 15. Bites on the face, neck and hands are thought to be the most liable to develop the disease, and punctured wounds are more dangerous than lacerated wounds because of the difficulty in cleansing them. In man the period of incubation varies widely, from 20 to 60 days is the usual range, but six months may represent an extreme limit. In exceptional instances the period of incubation seems to have been greatly prolonged. The pathological changes recently discovered are found to be extremely characteristic, so that it is now even possible to diagnose rabies in a dog within a reasonable time after his death.

In all cases of suspected hydrophobia it is best not to kill the dog; but if, by accident or design, the death is accomplished the body should at once be sent to the health board authorities for a confirmation of the diagnosis. The characteristic changes, as described by Nèlis in 1900, consist in minute alterations in the spinal ganglion cells, especially in a proliferation of the endothelial cells of the ganglionic cell-capsule. These changes are considered characteristic of this disease and are not known to occur in any other affection. The general treatment is both prophylactic and remedial. All stray dogs should be destroyed; or, if they have bitten anyone, they should be imprisoned and watched. It is best to have dogs muzzled or held in leash. In Germany muzzling has entirely eradicated hydrophobia. London in 1889 had 176 cases of hydrophobia. Muzzling was made compulsory, and in 1890 the number of cases of rabies had fallen to 44; in 1891 to 28; and in 1892 to 3. The muzzling was then allowed to lapse, owing partly to the sentimental agitation of many so-called lovers of dumb animals, and the cases of rabies increased, 25 persons dying of the disease in five years, while 174 patients were sent for treatment to the Pasteur Institute.

The direct treatment of the wound causing rabies is important. The poison seems to diffuse slowly, so that, if a ligature is promptly placed about the limb on the body side of the wound, a suction-cup or direct sucking may extract all of the virus. In the non-abraded mouth the virus is not very poisonous. If the wound is deep it is sometimes wise to make immediately a free incision, permitting the flow of blood to wash away the virus and also allowing a more open surface for the actual cautery. One of the best cauterizing agents to use is strong nitric acid. The after-treatment will depend very largely on the promptness and thoroughness of the first treatment. If there is reason to believe that the early cauterization was ineffectual, the Pasteur method of treatment (see PASTEUR, LOUIS) is advisable. This is a complicated method which was elaborated by Pasteur about 1880. He found that the virus was present in the spinal cord of a rabid animal; that its virulence slowly diminished after the death of the animal; that the virus could be artificially weakened by passing it through a series of monkeys until it was powerless; and that, conversely, this virulence could be restored by inoculating the attenuated virus in a series of rabbits. Thus Pasteur made a weak virus and a strong one at will, and he later produced immunity to the virus by the use of his attenuated material. The final plan that was adopted was to kill a rabbit by means of his strong virus, remove its spinal cord, cut this up into short sections and dry it for varying periods of time. In this manner he secured a graded series of cord-sections of gradually decreasing virulence. These were emulsified in salt-solution and used to inject into animals or man, the weaker virus being first used and the stronger later. Two methods are now in vogue — the simpler method, for the less severe bites, in which 19 injections are given in 14 days; and the intensive method, for the severe bites about the neck and face and the large nerve-trunks, in which 28 injections are administered in 21 days. The serum-treatment of the disease is also rapidly becoming a possibility. Two Italian investigators, Tizzoni and Centanni, have made an anti-rabic serum that promises something for the future. For the present, however, the Pasteur method is the most reliable. It is certainly harmless and is worthy of trial. The results are assuring and the statistics, to most minds, convincing. It should not be forgotten that there is a false hydrophobia which is of purely hysterical origin, during an attack of which some patients have died. Consult Bradford, 'Two Lectures on Rabies' (*Lancet*, 3 March 1900); 'Hydrophobia in Germany' (*Hygienische Rundschau*, 7 Nov. 1899); 'Report of Select Committee of the House of Lords on Rabies in Dogs' (Blue Book, 1887); *Medical News* (15 Aug. 1903); Sixteenth Annual Report Bureau of Animal Industry (1899). See HYSTERIA.

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HYDROPHYTES, plants which grow in water or mud. They may be wholly submerged, completely without roots, and derive their sustenance wholly from the water; or may live amphibiously, rooted in soil and lifting some or all of their leaves into the air, and so differ only in a greater or less degree from land plants. Adaptations of water plants are especially to meet the difficulty of obtaining oxygen and of effecting pollination under water. In plants which grow wholly in or under water, roots, when present, are comparatively small and free from hairs, stems are slender and abound in air-space, and leaves are, as a rule, either long and narrow, or else greatly subdivided, so as to expose the greatest possible amount of surface. The cuticle of the leaf, also, is very thin, and lacks several of the structures, such as palisade cells and stomata, always present in aerial leaves. Water therefore enters easily into the tissues of the plant and carries with it a large amount, not only of oxygen, but of dissolved nutriment, so that in any oceanic plants, and plants of ponds and rivers, no roots whatever are developed, and these live practically independent of any connection with the land. The fertilization of submerged cryptogams is effected by the passing of generative elements through the water, but only a few submerged phanerogams make such use of the agency of the water. The pollen of the eel-grass (*Zostera*) has been modified for under-water efficiency. It does not form round grains, but elongated thread-like filaments which have the same specific weight as the water, and hence neither float nor sink, but move about at the level of eel-grass growth until they come in contact with the stigma of some neighboring flower. In the duckweeds and some other submerged plants, the male flowers break loose, rise to the surface and float away like little boats carrying pollen to the female blossoms, which at that time have risen to the surface but sink again as soon as fertilized. The hydrophytes show many examples of exceedingly wide distribution, as might be expected of oceanic plants, but is not so easily explained of those of fresh waters, many genera and species of which, nevertheless, are cosmopolitan.

HYDROPLANE. See AEROPLANE.

HYDROQUININE, one of the five principal alkaloids of the cinchona barks, having the formula $C_{20}H_{26}O_2N_2$. It is found in nearly all samples of commercial quinine (sulphate). Its properties are very similar to the ordinary sulphate of quinia, but as it is soluble to a larger degree, it is more speedy in medical action, and requires a smaller dose to produce a like effect. It is usually prepared from the commercial quinine sulphate, which is dissolved in hot water and carefully recrystallized at the highest possible temperature at which the crystals will form. The hydroquinine remains in the mother liquor — along with the sulphates of any other of the cinchona alkaloids which may have been present in the sample. To this mother liquor is added slowly a solution of potassium permanganate until the whole is tinted a red which does not grow paler upon standing. It is then filtered to remove the precipitate, and the filtrate is made slightly alkaline with ammonia, and shaken with ether, which dissolves out the hydroquinine. The ether solution is drawn off and evaporated and the residue is dissolved with dilute sulphuric acid. Ammonia is then added in quantity just sufficient to neutralize the solution, and the hydroquinine crystallizes in long needle-like prisms.

HYDROQUINONE, QUINOL, or DIHYDROXY-BENZENE ($C_6H_4(OH)_2$), the most used of all photographic developing agents, being practically indispensable in the making of photographic prints on developing paper. Its characteristic property is the great density it gives to the developed image, to the point of harshness of contrast, and for this reason it is almost always combined with a «soft» acting developer, such as metol, edinol, eikonogen, rodinal, paramidophenol, etc. Hydroquinone fails to work if cold, when it has a tendency to deposit as crystals from the solution. The proper temperature is 65° F. in summer and 70° in winter. At higher temperatures it is liable to produce fog in the shadows and excessive intensity of the high lights.

Hydroquinone is prepared commercially from aniline. A dilution of sulphuric acid is made by dissolving 8 parts of the acid in 30 parts of water: this, when cold, is added to 1 part of aniline, and after cooling, 3½ parts of potassium bichromate, or sodium bichromate, is added so slowly as to avoid much rise in the temperature of the mixture. To the thick brownish liquid resulting is passed a stream of sulphurous acid gas until the mixture smells strongly of it. It is then filtered to remove the precipitate, and the filtrate is shaken with ether, which dissolves out the hydroquinone. The ether layer is drawn off and distilled, the ether being recovered, and the hydroquinone remaining in the forms of a yellowish (almost white) crystalline powder. It is purified by preparing a saturated solution with water and boiling it with animal charcoal and a little sulphuric acid, filtering and crystallizing.

If chlorine gas be passed through a solution of hydroquinone in benzol, monochlorhydroquinone is obtained, and this also is used largely as a photographic developer under the commercial name of «Adurol.»

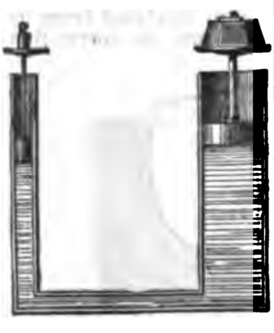
Previous to the war in Europe the entire American supply of hydroquinone had come from the laboratories of Germany. The chemical workshops of America were called upon to meet the demand, and are producing a quality of the reagent which is unsurpassed. The market, however, has been flooded by shamelessly adulterated samples of all photographic developers, and rigid tests are necessary for products where there is no guaranty by a manufacturer of known integrity.

HYDROSPHERE is a term used by geographers to designate the total of the water on the earth. It, therefore, includes the oceans, all lakes and rivers, the water-vapor in the atmosphere and that which has penetrated into the substance of the globe (lithosphere). To estimate the amount of this with accuracy is manifestly impossible, as we cannot easily calculate the bulk of the vapor, and know nothing about the amount contained in the rocks and spaces beneath the surface. It is possible to give some interesting facts as to the masses of water in the oceans and large inclosed seas and lakes on the surface of the earth. The latest calculations by physicists compute the area of the oceans and seas directly connected with them at 139,295,000 square miles, and the area of all lands, including inclosed lakes, etc., at 57,254,000 square miles. The water-area is, therefore, about three-fifths of the total superficies of the globe. Its mass, however, requires multiplication by depth, and the greater part of the oceanic area is covered by water more than 1,000 fathoms deep. Two-thirds are occupied by water exceeding 2,000 fathoms in depth, and one-fifteenth of the oceanic basins lies beneath more than 3,000 fathoms (18,000 feet) of water. The deepest place yet discovered is near Guam Island in the Pacific — 5,269 fathoms. This is equal to 31,614 feet, and it exceeds the altitude of the highest mountain (Everest in the Himalayas, 29,000 feet) by 2,610 feet. This makes the greatest known difference between the lowest and highest points on the earth's surface about 11½ miles; but it must be remembered that where as the mountain-tops are mere points, the «deeps» in the ocean floor are often areas of hundreds of square miles. It is, therefore, evident that were all the solid surface of the earth reduced to a level, the water would cover the globe to a very considerable depth — probably two or three miles. See LITHOSPHERE.

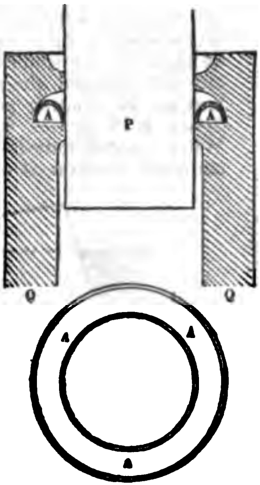
HYDROSTATIC PRESS, a machine for compressing, in which a liquid, as water or oil, pumped through a pipe of small diameter, is utilized to exert a multiplied pressure through the increased area of a much larger piston in the large cylinder: called also hydraulic press. The diagram illustrates the principle. Two tubes of unequal area are connected, and the whole vessel filled with water. Let the area of the smaller tube be one square inch, and let the piston that closes it be loaded with one pound.

A pressure of one pound per square inch will be exerted on every part of the boundary of the liquid. There will thus be a pressure of one pound per square inch put upon the piston that closes the larger tube; and if we suppose the area of the piston to be 16 square inches, it is evident that it must be loaded with 16 pounds in order that the pressure to which it is exposed may be equilibrated. Thus a load of one pound on the smaller piston supports 16 pounds on the larger.

The principle of the hydrostatic press was pointed out by Stevinus; but it was Joseph Bramah who, in 1796, by devising a tight packing for the cylinder, gave the principle practical application. The diagram shows a section AA of the collar surrounding the piston P, the shaded area QQ representing the walls of the cylinder. The collar consists of a circle of solid leather, or cup-leather AAA. When water pressure is applied to move the piston, some of it leaks into the ring-space AA, and the leather ring curls and swells, filling the space water-tight, so that there is no leaking. In modern practice this primitive device has been succeeded by a stuffing box, employing spring steel rings. See HYDROSTATICS; HYDRAULICS.



Principle of the Hydrostatic Press.



Cup-leather.

HYDROSTATICS, that branch of engineering science which deals with the mechanics of liquids at rest, and the action of forces upon static liquids; that is, the theories of pressure and equilibrium as concerning liquids, especially water.

The mechanics of confined liquids are based largely on the following conclusion: any increase of pressure at one point of a confined liquid is transmitted almost instantly to every other point. This proposition discards the minute modifications of capillarity, skin friction and surface tension, which are practically negligible; it also dismisses the almost infinitesimal compressibility of a liquid as inconsequential. A liquid has size but not shape; if poured out on a level table it covers the entire surface, and will fill all depressions, but its upper surface will be uniform and level. In a large body of water it is seen that this level conforms to the curvature of the earth. It is a common procedure to explain this level by referring it to the constant pressure of the atmosphere 14.7 pounds per square inch, and this is not misleading if it is borne in mind that the pressure of the atmosphere is due to the attraction of gravitation — to which the water level is actually attributable. A liquid offers no permanent resistance to forces tending to change its shape. The particles of a fluid are mobile; and while in the case of liquids very considerable forces of cohesion are exhibited, yet the particles show great freedom to alter their relative positions, and to pass from place to place within the general mass. A very important property that follows from the nature of fluids is that of the equable transmission of pressure. Suppose a liquid inclosed in a vessel A, which is fitted with a piston P. If pressure is applied to P it will be transmitted in all directions through the liquid. If other openings are made, and if they are fitted with pistons, it is evident that to keep each of these pistons in its place, pressure inward must be applied. The pressure that must be applied to any piston equal in area to the area of P is equal to the pressure on P; and if the area of one of the other pistons is greater or less than the area of P, the pressure required to keep it in its place is proportionately greater than or less than the pressure that is applied to P.

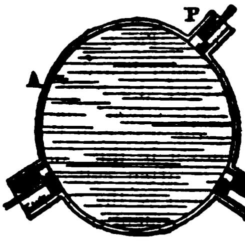


FIG. 1.

It is thus apparent that there is a normality of liquid pressure, and in calculating such pressure it is only necessary to consider one direction of pressure. The law is: Any additional pressure applied to a confined liquid at any point will be transmitted equally to any other point of contract. This principle finds application in the hydraulic press. It is to be noted, however, that water under static pressure does not produce work until it begins to move, and *moving* water comes under the head of hydraulics. These two divisions of science are therefore closely related, and need to be studied together. (See HYDRAULICS). In the apparatus known as the "hydrostatic bellows," a true hydrostatic equilibrium is obtained. This experimental contrivance consists of a pair of circular boards connected by a band of pliable leather fastened watertight around the circumferences of the boards (like a pair of bellows). A small tube inserted into an opening near the bottom connects a tall tube rising perpendicularly. Heavy weights may be put on the upper circular board, and if water be then poured into the upright tube they will be raised up by the pressure of the water from below. For the pressure to which the under side of the circular board is exposed is equal to the weight of a column of water whose section is that of the circular board, and whose height is the difference of the heights of the under surface of the top circular board and of the free surface of the water in the small upright tube. When shown in this form the principle here employed is often called the hydrostatic paradox, on account of the very great pressure that a very small quantity of water may be made to produce.

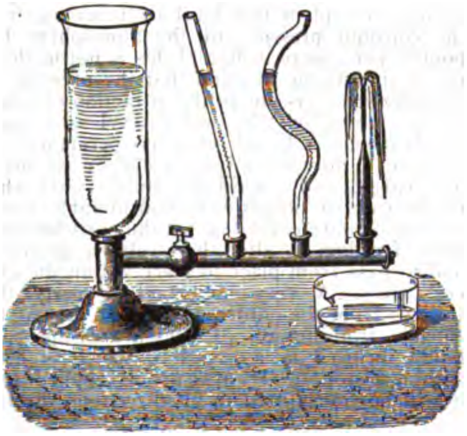


FIG. 2.

It is a well-known principle that liquids tend to find their own level. Thus, in the accompanying figure, showing a series of connected vessels, the liquid is seen to stand at the same height in the principal vessel and in the variously shaped tubes communicating with it, while from the short, narrow mouthed tube it spouts up to nearly the level of the water in the principal vessel.

Archimedes is credited with discovering the principle that a body immersed in a liquid displaces its volume of the liquid; and that it is buoyed up by a pressure equal to the weight of liquid it displaces. This principle is illustrated in the hydrometer (q.v.). When a solid is immersed either partially or wholly in a liquid, a portion of the liquid is displaced. The solid is at the same time pressed at every point by the liquid, the pressure being always perpendicular to the surface. The upward pressure on the solid is greater than the downward by an amount equivalent to the weight of the liquid displaced by the solid; for if, instead of the solid, the quantity of liquid displaced by it were present, its weight would be upborne by the pressure on every side. These pressures now act on the solid and whether or not the solid floats under their influence, as much of the weight of the solid as corresponds to this pressure is supported by the surrounding fluid. Experiments that are made for the purpose of determining the specific gravity of bodies heavier than water also depend on this principle. See SPECIFIC GRAVITY.

The conditions of floatage and of stability of a body floating in a liquid are of great importance. A floating body displaces a certain quantity of the liquid, and the weight of the solid body is equal to the weight of the liquid that is displaced by it. To calculate how much of the body is submerged, and how much floats above the liquid, it is only necessary to consider what volume of the liquid would be equal in weight to the weight of the floating body. For example, the specific gravity of ice is about nine-tenths of that of ordinary sea-water. Hence 9 cubic feet of sea-water weigh as much as 10 cubic feet of ice. Thus in an iceberg nine-tenths of the ice is under water, and one-tenth is above the surface. In ships and other floating bodies the stability depends on the form of the body. A sphere of wood floating in water is indifferent as to position. The slightest force is sufficient to overturn it from any given position or to set it rotating in the water. With a ship or other body that must float with one side upward, the stability is quite as important as the floating power. The accompanying figure 4 illustrates the conditions of stability. When a solid body is slightly displaced from its ordinary position of equilibrium, the forces that act upon it are seen to be two-fold. First, there is the force of gravity on the solid acting vertically downward, which, if G be the centre of gravity, may be considered to act downward through that point; and secondly, there is the resultant of the upward pressures of the various portions of the liquid, which, if O be the centre of these upward parallel forces, or centre

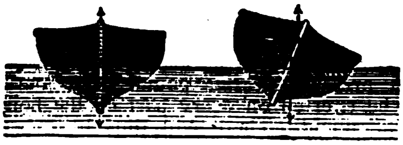


FIG. 3.

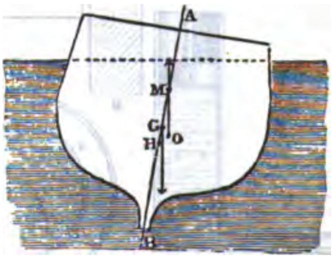


FIG. 4.

of buoyancy, may be considered as equivalent to a single force acting vertically upward through that point. In the figure these two parallel forces are seen to form a mechanical couple whose tendency is to right the boat, and bring it back into its ordinary floating position. The metacentre M is a changing centre, representing the centre of the two forces of gravity and buoyancy. The higher the metacentre above the centre of gravity the more stable is the vessel.

Let A B in the figure be a line drawn through the point G, the centre of gravity of the floating body, and H the centre of the figure of liquid displaced (also the centre of buoyancy) when the body is floating with A B vertical. Let the body be then slightly displaced, and let O be the new position of the centre of the figure of the displaced liquid, and let M be the point in which A B is cut by a vertical line through O: M is the metacentre which will be different or slightly different for every list. If the metacentre is above G then the equilibrium is stable; if it is below G the equilibrium is unstable, and the body being slightly displaced, it tends to fall farther and farther from its position of equilibrium. That a vessel may be stable and not overturn, it is apparent that the centre of gravity must be kept considerably below the metacentre. This is why vessels load the keels at times with lead, and why vessels without freight in the bottom of the hold, take in ballast.

Among the instruments and machines founded on the hydrostatic principles here laid down are the barometer, the siphon, the hydrostatic press, and the hydrometer (qq.v.).

The engineering problems involved in the stability of dams, water gates and reservoir walls are those of hydrostatics. The pressure of water behind such structures exerts a constant force toward overturning them, due to its tendency under the influence of gravitation to seek the lowest level. To counteract or counterbalance this force is placed the weight of the dam or wall — in other words the larger attraction which the earth has upon the materials of which they are built than it has for the water. The higher the body of water behind a dam the greater the impulse to run down hill, and hence the greater push against the dam which stands in its way. The form of solid which is most difficult to overturn by pressing against one side of it is that of triangular crosssection, and this is the one used by engineers for dams and reservoir walls. These triangular bodies are built with broad bases, and one "toe" of the triangle pushes up-stream under the water of the pond or lake, which helps in part to hold it down with its weight. Hydrostatic pressures exist also in all water-supply pipes, tending to burst them apart from within. The greater the head of the water-supply the greater the hydrostatic pressure, and the stronger the water-pipes must be made to hold it securely.

HYDROTHERAPY (Greek, ὕδωρ water, and, θεραπεία, cure), a method of treating diseases by the application of hot and cold water, which has come extensively into practice of late years, and is recognized by the medical profession as a very efficient therapeutic agent. The efficacy of water as a hygienic medicine has been recognized from the earliest times. Hippocrates, Celsus and Galen regarded water as of especial value in the treatment of acute diseases; and during the Middle Ages the same view was advocated bv many famous physicians. Duing the 18th century there was a growing belief in its virtue as a curative agent, though rather in acute than in chronic diseases. Some physicians used water for internal treatment, others for external treatment, but hydrotherapy, as now understood, combines both methods. It was originated by Vincent Priessnitz, a Silesian peasant. When a boy of 13, having sprained his wrist, he applied it to the pump, and afterward bound a wet bandage upon it. As this became dry he rewetted it, and thereby reduced the inflammation, but produced a rash on the surface of the skin. Shortly afterward he crushed his thumb and applied the wet bandage as before, and again an eruption showed itself. He concluded that the rash was an indication of impurity of blood; and having instituted a series of observations in regard to various wounds and ulcers on the persons of his neighbors, he was led to form a pathological theory, according to which disease is caused by an accumulation of morbific matter, which must be eliminated from the system by cold water applications and the observance of a strict regimen. His views were confirmed by an accident to himself, in which, through a cart running over him, he received some broken ribs and severe contusions and was given up by the physicians; but on learning their opinion he tore off their bandages and applied others wet with cold water. He also replaced his ribs by inflating his lungs while pressing his abdomen against the window-sill. Either through or in spite of this treatment Priessnitz recovered and the carrying out of this cold-water theory became the object of his life. In rapid succession he invented the sponge-bath, the wet-sheet packing, the sitz, foot and arm baths, the douche, the steam-bath, the dripping sheet, the plunge, the dry-blanket packing and other appliances of the hydropathic system. In 1829 he established, at his native village of Gräfenberg, a range of baths, which speedily grew in reputation and attracted visitors from all parts of Europe. The Austrian government lent him its patronage, and all the opposition of the medical faculty was unable to stem the popularity of the new system. The original establishment at Gräfenberg soon expanded into an extensive suite of buildings, stretching along the slope of one of the Sudetic Mountains, and resorted to by troops of invalids, who sought to regain health by bathing, exercise, simple diet and agreeable society. Similar institutions soon sprung up in other parts of Germany and were at length introduced into England, a hydropathic society having been formed in London in 1842. At the present time hydropathic institutes exist in great numbers throughout the world, and so universal have hydrotherapeutic procedures become that a large body of quacks thrive on the prestige given to hydrotherapy by regular physicians. The theories of Priessnitz are now known to be fallacious.

The work of Winternitz and his disciples has put the general principles of hydrotherapy on a rational footing; there is little doubt, however, that hydrotherapy, like any other therapeutic agent, may be greatly abused. It is by no means a universal panacea. There are a large number of ways of applying hot and cold water to the body. One enthusiastic advocate has described over 300 separate kinds of application. In general, however, the water may be applied in the shape of tub-baths, ablutions, packs, rain-baths and douches. These may be divided and subdivided as indicated. *Tub-baths* may be full, half or local baths, as to the pelvis, the feet, the hands, etc. The full tub-bath is usually given at a temperature of 55° F., unless special indications are to be met. If the patient's reaction is not of the best, the temperature should be about 60° F., and vigorous friction of the skin should be maintained. The time spent should be short, 10 to 20 seconds. The full tub-bath is a strong tonic. In severe illness the tub-bath should be given only by a trained nurse under the physician's orders. Half-baths are taken at a temperature of 60°–75° F. After wetting the face and chest the patient sits in a tub about one-third to one-half filled with water, sufficient at least to cover the legs and the pelvis. The attendant splashes the cold water over the patient's body, maintaining at the same time a vigorous friction by means of a flesh-brush. The time is from one to five minutes, but the bath should not be continued if the teeth begin to chatter or if there is any evidence of defective reaction, as blueness of the lips, or thin pulse. Local cold baths, such as sitz-baths and foot-baths are very important hydriatic measures. The cold foot-bath, plunging the feet for one to three minutes in cold running water, is of service in sluggish circulation of the feet, neurasthenia and hysteria. Warm full baths at a temperature of 90°–98° F., for a period of from 5 to 20 minutes are very useful as sedatives to the nervous system, particularly so in insomnia and nervousness from overwork, especially when taken at night. The best effect is obtained if they are taken at the time of retiring and are followed by a brief application of cold water, either in the shape of a half-bath, or a douche. After the bath the patient should wrap up in a linen sheet and a blanket to keep up the dilatation of the blood-vessels of the skin. Perspiration is to be avoided, save in particular instances.

Ablution.— This is one of the simplest of hydriatic measures. It is a valuable skin and nerve tonic, and is particularly adapted for children and women. It consists in the application of water to the body at a temperature of 50°-60° F., from the hollow of the hand, or by means of a bath-glove or wash-cloth. The entire body is gone over, one part after another being systematically treated. One to two minutes' application followed by vigorous rubbing with a coarse towel or flesh brush is sufficient. Ablution is particularly valuable for reducing temperature, often bringing about quiet, restful sleep in tossing and fretful children.

Affusion.— In this treatment a volume of water from a pitcher or a pail is poured over the entire body, or upon certain parts, the patient sitting or standing erect in a tub or bath. The temperature should be 50°–60° F., and the whole procedure should not consume over 10 or 15 seconds. The reaction is obtained by rubbing. In certain muscular tremors, in neurasthenia, etc., this procedure is of service.

Packs or Compresses.— These may be dry or wet, general or local. The dry and wet packs are applied in the same manner. The patient is placed on a narrow bed or couch with a rubber sheet, a blanket and a linen sheet beneath him, the blanket and sheet falling on each side of the couch. The sheet is then brought up and, with the arms to the side, wrapped thoroughly about him, the face alone being exposed. The blanket is then wrapped about the patient in a similar manner. Cloths wrung out in cold water may be applied to the head. In a wet pack the sheet is first wrung out in cold water; in the dry pack it is frequently warmed. The object of the application is to bring about free perspiration, and this is the usual result. Hot drinks may be administered freely. The time given to the application will depend largely on the conditions to be met. If reduction of temperature alone is desired, the patient may remain in the pack until the perspiration is free, and he may then be wrapped up in a dry blanket. In certain uræmic states, and in infantile convulsions, a longer period may be necessary. The wet pack is an excellent procedure in the treatment of alcoholic excesses. The initial effect of a cold pack is constriction of the blood-vessels; this is soon followed by a dilatation which continues throughout the application and is the main cause of the free perspiration. The pulse-rate is reduced and the arterial tension falls. The stress of elimination is taken from the kidneys, the amount of blood within the brain diminishes and sleep is encouraged. In the hot general pack a blanket only is used. This is wrung out in water at 140°–150° F., the temperature at the time of application not being over 105°–108° F. Local packs or compresses are of inestimable service in a variety of conditions. These are usually made of pieces of heavy muslin, canton flannel or linen, varying in shape according to the site of application. They are wrung out in cold or hot water and applied to the head in headache, to the neck in sore throat, tonsilitis, diphtheria, earache; to the chest in pleurisy, pneumonia, neuralgias; to the heart in rapid overacting heart-action; to the stomach in indigestion; to the joints in sprains, rheumatism and gout; to the abdomen in gastroduodenal catarrh, irritable bladder, catarrhal appendicitis, colitis, peritonitis. Hot applications are particularly serviceable in painful menstruation. Hot water-bags have largely taken the place of hot compresses since they have been made so handy in shape and size and so reasonable in price.

The Douche.— This application is one of the best tonics, but requires special rooms for its use. These are found in the best appointed hydropathic institutes. The douche consists in the application of hot and cold water delivered through a hose. It combines the elements of the water, heat, cold and force. The regulation of the pressure and temperature is an important feature in the scientific use of the douche. See BATH.

Bibliography.— Cohen, 'Physiologic Therapeutics Hydrotherapy' (1902); Baruch, 'The Principles of Hydrotherapy' (1900); Kellogg. 'Hydrotherapy' (1902).

HYDROTHORAX, dropsical collection occurring in the pleura, which when aggravated exert pressure on the lungs and con[illegible] interfere with the blood circulation. The external sign is a livid countenance accompanied by difficult breathing. In aggravated cases the fluid is tapped and drawn off through a hollow needle.

HYDROTROPISM, the property possessed by most roots and by other plant-organs of growing in the direction of the greatest moisture. It is not only possible to demonstrate by experiment that the growth of root-hairs is in the direction of the greatest water content, but it can also be shown that the root actually curves toward moisture. The advantages of hydrotropism are evident, inasmuch as it enables the plant practically to go in search of water at those times when the supply is more or less inadequate. The stimulus appears to act as follows: the water, absorbed more rapidly on the side of its greatest abundance, doubtless causes an osmotic swelling and tension greater on that side than on the other; and this difference is ample to establish a line of direction toward which the roots turn in their growth. Stems and leaves display no hydrotropism at all, as they do not absorb any water under normal conditions; its one-sided abundance is a matter of indifference to them; it being a general rule that plant parts are indifferent to stimuli to which there is no profit in responding. Tree roots sometimes extend themselves toward a drain and introduce themselves through a crevice in the tiles; finding a combination of air, water and mineral substances they grow profusely, sometimes to so great a degree that they choke the drain completely.

HYDROZINCITE, or ZINC BLOOM, A white mineral consisting of basic zinc carbonate supposed to be $3ZnO.CO_2.2H_2O$. A common ore mined in Arkansas, Kansas and New Mexico, and also occurs in Inyo County, California and Tintic District, Utah.

HYDROZOA, a class of *Cœlenterata* (q.v.) embracing the polyps, all of which bear a general resemblance to *Hydra* (q.v.). There are two alternating generations, that is, (1) the sessile asexual polyp, which gives rise to (2) a jelly fish or medusa. The hydroid polyp is like hydra, a two-layered vase-like sac, with a circle of tentacles around the mouth. This gives off by a budding process a bell-shaped medusa, which is much more highly organized than the polyp, having a well-developed digestive and nervous system, and sense-organs (eyes and ears, or otocysts). They have the peculiar cells known as Nematocysts (q.v.), which are numerous in the tentacles, and secrete a fluid resembling formic acid, which may be exploded with danger to their enemies. The *Hydrozoa* are cnidaria capable of producing two different types of individual, the polyp and the medusa. (See GORGO). Each of these develops from the egg through the blastula, porenchymula, gastrula and actinuala. The *Hydrozoa* are at present divided into seven orders, the most important of which are, besides *Hydraria* represented by hydra: the *Hydrocorallinæ*, of which *Millepora* (q.v.) is the type; the *Tubulariæ*, comprising *Hydractinia*, *Tubularia*, etc.; the *Campanulari*, of which *Campanularia*, *Clytia* and *Obelia* are examples. Near this group belongs the extinct order of *Graptolites*, which were floating forms living in the Paleozoic seas. The last order (*Siphonophora*) comprises the Portuguese man-of-war (q.v.) and other forms, which are beautiful transparent pelagic animals, very brightly colored and highly specialized. An interesting type is the *Actinozoa* and the subclasses *Zoantharia* and *Alcyonaria*. Consult Hickson, 'Coelenterata and Ctenophora' (in 'Cambridge Natural History,' Vol. I, 1906). See JELLYFISH; POLYP.

HYENA, hī-ē'nā, one of a family (*Hyænidæ*) of carnivorous mammals, having relations in structure to the bears, the cats and the civets, familiar in Africa and southern Asia. They are of considerable size, about 150 to 250 pounds for adults, have large, rather short heads, powerful forequarters, feeble and drooping hindquarters and short tails. The eyes are large, and have longitudinal pupils; the ears are long, erect, very open, and directed forwards. The teeth are numerous, massive, tuberculated, and well adapted to aid the muscular jaws crunch the strongest bones, as hyenas are able to do. Hyenas are nocturnal animals which pass the day in solitude in caves or other hiding places, which they quit at night in order to seek their prey in bands. Carrion is a favorite food, and the stench attracts the hyena by night as it does the vulture by day. In some cases they dig up dead bodies and devour them. They also prey on living animals, and flocks of sheep and goats suffer severely from their ravages in some localities. The common or striped hyena (*Hyæna striata*) is a native of Northern Africa and parts of Asia, even eastward to Burma. It is brownish-gray and marked with bands of darker brown on the body, which become oblique on the flanks and legs. The hair upon the line of the back is much thicker and stronger than on any other part, forming a sort of mane, extending from the nape of the neck to the origin of the tail. This species was well known to the ancients, who entertained many absurd notions respecting it, believing that its neck consisted of but one bone; that it changed its sex every year; that it could imitate the human voice, etc. The notion as to the neck is doubtless due to the fact that in age the neck vertebræ are apt to become anchylosed. It is a most uncouth and disagreeable animal, singularly homely, with a sneaking carriage, a fetid breath, and a glandular pouch beneath the anus, of most unpleasant odor. It was formerly supposed that the hyena was untamable, but that it can be completely tamed there is not the shadow of a doubt. The spotted hyena (*H. crocuta*) has a considerable resemblance to the former species, but is larger, and is marked with numerous round blackish-brown spots instead of stripes, nor is the mane so large. This species inhabits many parts of Africa, and was formerly very numerous around the Cape of Good Hope. There is another species, the brown hyena (*H. brunnea*), which differs from the preceding by having stripes on the legs, the rest of the body being of a dark grayish-brown. It also inhabits the south of Africa. An extinct species, the cave hyena, was abundant in England, France and Germany anterior to the glacial epoch, and has left its remains in many caves of these countries. Though named *H. Spelæa*, it seems practically identical with the existing *H. crocuta*. The fossil ancestry goes back into the tertiary whence it seems to have sprung from the same stock that gave rise to the viveroids. Consult writers upon nature and sport in Africa and India; Sydecker, 'The Game Animals of Africa' (1908); Roosevelt and Heller, ‘Life Histories of African Game Animals’ (1914).

HYENA-DOG, an African canine animal (*Lycaon pictus*), which takes its name from its hyena-like appearance in shape and color, and is also called Cape hunting-dog because it hunts in packs. It differs from the typical dogs in having only four toes on both the fore and hind limbs, and in its dental fauna, and it seems to be a comparatively recent immigrant into South Africa, since its bones are found in British caves. It preys upon antelopes, cattle, etc., and was a scourge to the early settlements, when it was more numerous and bold than now.

HYÈRES, ē'ăr', France, a town in the Department of Var, in the southeastern part, 10 miles east of Toulon, with which it is connected by rail. With its suburb, Costebelle, it is a very popular winter resort. At the sea coast, a distance of two and one-half miles, is situated the harbor of Hyères, off which are three little islands called the Iles d'Hyères. The town is located on the southern slope of a hill belonging to the chain of Montagnes des Maures. It is sheltered, has a salubrious climate, and is noted for its fine fruits, vegetables and flowers. The chief objects of interest are the parish church of Saint Louis, dating from the 13th century, the hôtel de ville, library, zoological gardens and a museum. Salt is extensively cultivated. Hyères was founded in about the 10th century, as a harbor from pirates. It was strongly fortified.

HYGEIA, hī-gē'ya, according to the Greek tradition, the goddess of health. The name was used at first in the allegorical sense; but later Hygeia came to be regarded as the daughter of Asclepius, and, by some cults as his wife. The origin of the introduction of the worship of Hygeia, together with the date and place of its incipiency are difficult to trace. At Titane in Sicyon, her worship appears to have been synchronous with that of Asclepius. The cult came from Epidaurus to Rome in the 3d century B.C., where Hygeia was latinized as Valetudo and her worship identified with Salus. At Oropus, she was associated with Amphiaraus, the god of healing; at Athens, the name Hygeia was one of the attributes of Athena, to whom an altar was erected on the acropolis after the great plague. Hygeia is represented as a vigorous young maiden, often accompanied by her father. Consult Roscher, ‘Lexikon der griechischen und römischen mythologie’ (Vol. I, Leipzig 1884–90).

HYGIENE, broadly the science and art of preserving and improving health. Health in this instance is defined as soundness of body, that is, such a condition of all its several parts that they are able to perform their functions without difficulty, and every natural appetite can be satisfied without consequent distress. A typically healthy man is defined as one who lives vigorously, who in every part of his life, wherever it may be, does the largest amount of the best work that he can, and, when he dies, leaves healthy offspring. The objects of hygiene are the rendering growth more perfect, decay less rapid, life more vigorous, and death more remote. It is sometimes called preventive medicine, but it includes more than prevention; and is sometimes referred to as sanitary science, or the science of health; but its aim is not merely to know, but to act in view of what is known. It is an ancient art, some of its most important precepts formed a part of the wisdom of the Egyptians at least 1500 B.C., and it is probable that from this source were derived many of the sanitary regulations of the Jews as given in the Levitical code. The Mosaic laws recognize the three great principles of cleanliness, isolation, and wholesome diet with a thoroughness that leaves little to be desired. Hence, the Jews were almost immune for many centuries from the plagues which swept away their Christian neighbors; this was one reason why they were often suspected of starting or spreading the plagues. Thence also, through Pythagoras and the earlier Greek philosophers who studied in Egypt, came the rules of the Asclepiadæ, and a large part of the teachings of Hippocrates on this subject. In Egypt, Assyria, India and among the Jews, hygienic rules were framed by the priests, and were promulgated and enforced as a part of their religious systems, the reason given for many of these rules, such as for ceremonial ablutions, for the avoidance of certain foods, for circumcision and other matters connected with sexual hygiene, for the disposal of the dead, and for dealing with certain forms of contagious disease, being simply that they were Divine commands. Under the influence of Greek philosophy these rules were modified and placed upon another basis, the effects of various kinds of diet and exercise were discussed, and finally the famous treatise on airs, waters and places, by Hippocrates, placed the whole subject on a much broader foundation than it had before occupied. In so far as public hygiene is concerned, the ancient legislators had in view what they considered to be the benefit of the community or nation solely, and enforced their regulations to this end with little or no regard to the rights or welfare of individuals. The Jewish laws provide for driving out lepers and destroying their houses, but not for the care of the lepers themselves. The maxim of the Roman law, *Salus reipublicæ suprema lex*, was executed in the same spirit. Modern hygiene endeavors to preserve both the community and the individual, recognizing that each has rights which should not be sacrificed for the benefit of the other. As regards personal hygiene, the teachings of the Greek and Roman writers, and of those of the Middle Ages, consisted mainly of rules for diet and exercise intended for the benefit of kings, nobles and the wealthier classes. The typical ancient work on personal hygiene is the ‘Code of Health’ of the school of Salernum, which dates from about the 12th century, and was first printed in 1480. It was several times reprinted and for over two centuries was the most popular book in existence. The great epidemics of the Middle Ages, from the plague of Justinian to the Black Death, seem to have had little effect in advancing hygiene; they were supposed to be visitations of Providence against which human means availed not. In the 18th century some elementary ideas of hygiene had become known: the prevention of scurvy by lemon juice and vegetable diet, of jail fever by less crowding and more cleanliness, and of smallpox by inoculation, were among the foremost advances. Our new scientific acquaintance with ultimate causes for the first time enables us to make hygiene a true science on a basis of exact knowledge. The next step made in the 19th century, was the recognition of the difference between typhus, typhoid and relapsing fevers, which pointed to different causes and therefore require different methods of prevention. The establishment of a general system of registration of deaths in England in 1838 was a most important step in its influence as public hygiene. The cholera epidemic of 1832 differed widely in the mortality caused by it in different places, and as this became known, public interest on the subject of the causes and possibilities of preventing certain diseases increased, until, in 1849 a committee on the health of towns, appointed by the House of Commons, made a most important report upon water supplies, overcrowding, etc. Thereafter development was rapid and by 1858 a general board of health was appointed for the suppression of health nuisances, etc. The scientific foundations of public hygiene were laid by such men as Pettenkofer, Pasteur and Koch, and their pupils.

Public Hygiene.—A very great part of the work of public sanitary officers consists in the prevention of the specific infections and contagious diseases which are liable to become epidemic in a community, and as the majority of these are now believed to be due to microorganisms, the efforts of health officials are largely directed to measures which will either prevent their introduction or dissemination or will make the surroundings unfavorable for their development, or will destroy their vitality if they are present. The present methods of quarantine or maritime inspection, of isolation of cases of contagious disease, and of disinfection, are based mainly upon the results of bacteriological research, and differ in many respects from those in force a generation ago. The greater the number of persons residing within a limited area, the greater is the need for a general system of sanitary regulations which will prevent individuals from causing or spreading disease, and will secure to each one pure water and air. The greater part of public hygiene, therefore, may be said to be municipal hygiene, and the problems which present themselves to city and town authorities in regard to it are numerous and complicated. It includes general climatic conditions, soil under human habitations, the character of the latter and their cleansing, the disposal of refuse and excreta, and the cleansing of streets.

Climatic conditions cannot to any extent be modified: they must be neutralized, when insanitary, by other conditions pertaining to hygiene. All nations have more or less adapted their habits to their climate, unless acclimated so that they become part of its working: the hours of work or travel, the character of dwellings, the sites, the diet found wholesome by experiment, all form part of a hygienic system built up by social experience and tradition. Those unacclimated may have personal advice from predecessors; too often nothing but personal experience can be of any avail, and frequently that is only acquired by fatal results.

The subject of dwellings includes a number of considerations. The site, if possible, should not be one where the ground water is near the surface, or freshets or tides set back the drainage of closets, or where there are great fluctuations in the level of the ground water, which it is better to have nearer the surface and steady than lower and more unstable. Filled-in land in cities is often unhealthful, but tenants cannot in practice exercise much choice; the city authorities should prevent bad results by thorough sewerage with a good fall. The construction most important to have right is the plumbing, including the drains at the bottom; it is a commonplace which need not be dwelt on, that leaking sewer pipes and clogged drainage mean the infection of a house with disease-laden air. Paint is better than paper for walls, as it can be washed; and old paper should be scraped off before new is laid on. When possible rooms should be large enough not to need incessant change of air; when not possible, as is usual in cities, plenty of windows and the fullest possibilities of draft should make up; if this, too, is not available, the best systems of artificial ventilation. Unhappily, science is very backward in this class of invention, and small, close, unventilated rooms shorten millions of lives and prematurely break down working power in even the civilized cities of the world. The normal supply should be at least 3,000 cubic feet of air per head each hour, and this largely increased in work or sickness. The volume of consumption and other scrofulous diseases, bronchitis, pneumonia, etc., is directly dependent on foul air, which also increases the virulence of all zymotic diseases. The ventilation of public buildings rests on the same principles and has the same result. The warming of houses is of great importance, and is generally ill done, with disregard of ventilation. The vast majority of houses in America are overheated even when the air-supply is enough, giving a sensitive skin which very readily "catches cold." The water-supply is a matter of public concern: where there is a flat price, people do not stint themselves. Where there are meters, they often do; but toilets should be kept fully flushed at any cost. In country houses, where city water and sewerage are not available, it is necessary to insist on the frequent cleaning and disinfection of receptacles for excreta. Advice on this point is obtainable gratis from physicians, public health officers and others. If the dry methods are carefully used, they have many advantages in healthfulness over the elaborate city systems.

Personal Hygiene.—This has very many divisions: the most obvious are considerations of food, and drink, nerve stimuli, clothing, cleanliness, natural necessities, work and rest, and moral self-control. In the matter of diet, there can be no one rule: "at forty," says the proverb, "one is either a fool or a physician"; and each must use his own experience as a guide to whether meat is a necessity or vegetarianism an advantage, what foods agree with him, whether dry meals give him heartburn or drinking with them impedes digestion, and whether he is eating so much as to make him heavy, impairing his capacity for work and enjoyment, or making his body gross. In general, probably professional and sedentary workers as a class over-eat, and would find their minds more alert and their bodies freer from disorders with less gratification of appetite. Nerve stimuli, ranging from tea, coffee and cocoa, tobacco, alcoholic drinks and opium, are hard to frame a general rule upon; they, too, have infinitely varied effects. Cocoa is largely a food; coffee with most is an agreeable stimulant, with many an active nerve-poison, producing heavy headaches and incipient stupor; tea is a real nerve food on occasion and in small quantity, while taken steadily and largely it is a poison and a very mischievous one; tobacco sparingly used by grown men probably does little harm, and sometimes saves worse things, but should not be used by those under age, nor by those with weak nerves, and is highly injurious in heart disease, Bright's disease, and veneral diseases; alcoholic drinks suggest too many questions for discussion here; narcotics like opium, hashish, etc., as well as chloral and its like, should be used only on a physician's prescription. Clothing, if there is time and means, can be accommodated to changes of weather and occasion so as greatly to advance health; with most, there must be a rough average. Personal cleanliness within limits is a *sine qua non* of reasonable immunity from disease, and with delicate persons, of reasonably good ordinary health; but even this good thing can be irrationally overused and made mischievous. Too frequent hot baths in a northern climate are a great aggravator of lung-diseases, and one great city (Pittsburgh) had a marked decrease of pulmonary complaints one winter when the water-supply broke down, and people resorted greatly to dry rubbing. Especially it is possible to use too much soap, and keep the natural oil of the skin washed away. Natural necessities should be attended to more constantly than they are: workmen especially often grudge the time, but the waiting till there is severe pressure often creates dangerous bladder and intestinal complaints. Work, for most, is not under their own control; but to some extent resting is, and the average American perhaps owes more to compulsory public holidays than he is aware. There is more temptation to overwork than to idle, for the average man. Exercise should be taken by the sedentary, even a homespun housemethod being preferable to nothing. Grotius preserved his health in prison by whipping a top two hours a day. This should be one of the most rigidly imposed forms of self-control, which in all forms is all-important. Excessive sexuality, either of act or imagination, is simply destructive of will-power as well as bodily fibre; giving way to fits of anger or despondency is almost a recipe for entire nervous wreck. As to laziness, of mind or body, it is one of the worst and most incurable forms of this evil.

The management of children is really personal hygiene, only controlled by another than the subject; the care of the dead belongs to public hygiene; the prevention of disease belongs either to medicine, by the use of drugs like quinine or inoculations, or to house-hygiene as disinfection. The hygiene of the sick-room should be under the direction of the physician. See Bacteriology; Bath; Dress; Cookery; Dietetics; Disinfection; Exercise, Physical; Educational Athletics; Hospitals; Nursing; Plumbing; Sanitary Science and Public Health; Waters, City, Disposal of; Ventilation; Hygiene, Military; Military Sanitation; Water-Supply.

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HYGIENE, Military. In all modern armies special attention is given to the personal hygiene of the soldier. Camp diseases are preventable and their presence in a command shows that the laws of hygiene have been violated. In ordinary campaigns sickness disables from five to ten times as many as wounds and any deliberate disregard of sanitary regulations should be regarded as a grave military offense and dealt with accordingly.

In a modern engagement it requires, on an average, an expendiure of from 200 to 400 rounds of ammunition for each one of the enemy put out of the fighting, and considering the number of rounds carried, this expenditure represents the effectiveness of from one to two men. When it is realized that but a single cupful of polluted water may be equally damaging by rendering a fighting man unfit for duty for many weeks, if he survives at all, and may be the means of spreading disease far and wide in a command, then the great importance of faithfully observing hygienic precautions will be appreciated. A great many diseases are due to germs, which are either little animals or small plants so very small that they can only be seen by aid of the microscope. All diseases caused by germs are "catching." All other diseases are not catching. Persons may have these germs sometime without apparently being sick with any disease.

Care of the Body.— As certain mosquitos can transmit malaria and yellow fever, use the mosquito bar for this reason as well as for personal comfort.

Keep the mouth clean by brushing the teeth once or twice a day. Decayed teeth cause toothache and lead one to swallow food without properly chewing it, and this leads to stomach troubles of various kinds. Food left around and between the teeth is bad for the teeth and forms good breeding places for germs.

Keep the skin clean. Through the pores of the skin the body gets rid of much waste and poisonous matter. Therefore remove this and keep the pores open by bathing once every day, if possible. If water is scarce, rub the body over with a wet towel. If no water is at hand, take a dry rub. The skin protects the sensitive parts underneath from injury and helps to keep out germs. Therefore when blisters are formed don't tear off the skin. Insert a needle under the skin a little distance back from the blister and push it through to the opposite side. Press out the liquid through the holes thus formed. Heat the needle red hot first, with a match or candle, to kill the germs. When the skin is broken (in cuts and wounds) keep the opening covered with a bandage to keep out germs and dirt; otherwise the sore may fester. Pus is always caused by germs.

Keep your hair short. Long hair and a long beard in the field favors skin diseases, lice and dandruff.

Don't let any part of the body become chilled, as this very often is the direct cause of diarrhœa, dysentery, pneumonia, rheumatism and other diseases.

Wet clothes may be worn while marching or exercising without bad results, but there is great danger if one rests in wet clothing, as the body may become chilled.

When hot or perspiring or when wearing damp clothes, don't remain where a breeze can strike you.

Every day, if possible, hang your blanket and clothing out to air in the sun; shake or beat them with a small stick. Wash your shirts, underwear and socks frequently. The danger of blood poisoning from a wound is greatly increased if the bullet passes through dirty clothes.

Pitch your tent as soon as you can, particularly a shelter tent, even if you camp for one night only.

Always prepare your bed before dark. Level off the ground and scrape out a little hollow for your hips. Get some straw or dry grass if possible. Green grass or branches from trees are better than nothing. Sleep on your poncho. This keeps the dampness from coming up from the ground and chilling the body.

The use of intoxicating liquor is particularly dangerous in the field. Its excessive use, even at long intervals, breaks down one's system. If alcohol is taken at all, it is best after the work of the day is over. It should never be taken when the body is exposed to severe cold, as it diminishes the resistance of the body. Hot tea or coffee is much preferable under these circumstances.

Care of the Feet.— A soldier cannot march with sore feet, and marching is the main part of an infantryman's daily duty in the field. All soldiers should be familiar with the proper methods of caring for the feet. Sore feet are generally due to carelessness, neglect or ignorance on the part of the soldier.

The most important factor in the care of the feet and the marching ability of the soldier is the shoe. Civilian shoes, particularly light, patent leather or low shoes, are sure to cause injury and in time will ruin a man's foot. Only the marching shoe issued by the quartermaster corps should be worn, and they must be properly fitted to the individual. New shoes should be properly broken in before beginning a march by wearing them for several hours daily for a week before the march, and they should be adapted to the contours of the feet by stretching them with shoe stretchers with adjustable knobs to take the pressure off painful corns and bunions. Such stretchers are issued by the quartermaster corps, and there should be one or more pair in every company of infantry. On taking the shoes off a very little neat's-foot oil should be rubbed into the leather to prevent its hardening and cracking. If it is desired to waterproof shoes at any time, a considerable amount of neat's-foot oil should be rubbed into the leather. Waterproof leather causes the feet of some men to perspire unduly and keeps them constantly soft.

Light woolen or heavy woolen socks are habitually worn for marching. Cotton socks are not worn unless specifically ordered by the surgeon. The socks should be large enough to permit free movement of the toes, but not so loose as to permit of wrinkling. Darned socks, or socks with holes in them, should not be worn in marching.

As soon as possible after reaching camp after a day of marching the feet should be washed with soap and water, and the soldier should put on a dry pair of socks and his extra pair of shoes from his surplus kit. If the skin is tender, or the feet perspire, wash with warm salt water or alum water, but do not soak the feet a long time as this, although very comforting at the time, tends to keep them soft. If serious abrasions appear on the feet, or corns, bunions and ingrowing nails cause trouble, have your name placed on sick report and apply to the surgeon for treatment. Cut the toe nails squarely (fairly close in the middle, but leaving the sides somewhat longer), as this prevents ingrowing nails. A footsore army is an army half defeated.

Water.— Immediately on making camp a guard should be placed over the water supply. If the water be obtained from a stream, places should be designated for drawing water (1) for drinking and cooking, (2) for watering animals, (3) for bathing and washing clothing. The first named should be drawn farthest up the stream; the others, in the order named, downstream. If the stream be small, the water supply may be increased by building a dam. Small springs may be dug out and each lined with a gabion, or a barrel or box with both ends removed, or with stones, the space between the lining and the earth being filled with puddled clay. A rim of clay should be built to keep out surface drainage. The same method may be used near swamps, streams or lakes to increase or clarify the water supply. Water that is not known to be pure should be boiled 20 minutes; it should then be cooled and aerated by being poured repeatedly from one clean container to another, or it may be purified by approved apparatus supplied for the purpose. Arrangements should be made for men to draw water from the authorized receptacles by means of a spigot or other similar arrangement. The dipping of water from the receptacles, or the use of a common drinking cup, should be prohibited. See Military Sanitation.

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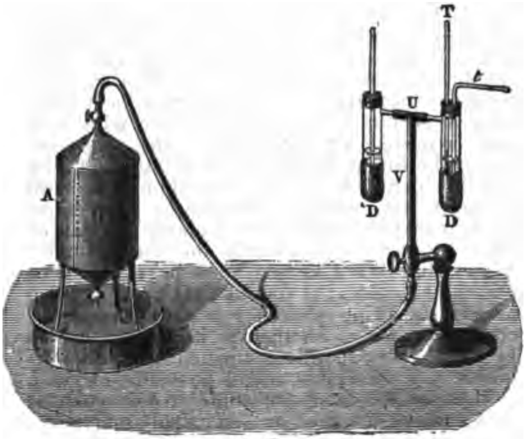
HYGIENE, Social. See Social Hygiene.

HYGINUS, Gaius Julius, Latin author. Little is known of his life, except that he came from Spain or Alexandria, studied under Cornelius Alexander Polyhistor, and was made a superintendent of the Palatine Library under Augustus. He wrote on many subjects, ranging from agriculture to commentaries on Virgil and Ciuna, all of which have been lost. Two works attributed to him are the ‹Fabularum Liber,› containing legends and biographies of the gods, with many valuable references to lost literary masterpieces; and ‹De Astronomia,› a treatise on the stars, dealing with the myths and legends connected with the heavenly bodies. The identity of the author of both of these treatises is well established, but various theories have been advanced to explain the poverty of the scholarship of the translation from the Greek. The most plausible of these is that the works, as they have been handed down to us, are an abridgment of the original by an inferior Latin scholar of the latter half of the 2d century. Consult Schang, 'Geschichte der römischen Litteratur' (3d ed., Munich 1911).

HYGROMETER (Gr. "moisture-measure"), an instrument for determining the degree of humidity or of moisture present in the atmosphere; when of primitive form, calculated only to show the difference between a dry day and a damp day, called hydroscope as when constructed of catgut, hair or other fibrous material, having the property of lengthening when wet and contracting when dry. Sausson's hydroscope employs a human hair, the stretching or shortening of which with variations of moisture in the air moves a pointer on a graduated arc. A similar machine is Richmond's hydrograph, in which the hair is wrapped around a screw-thread, turning a cylinder as it lengthens or contracts, so that a connecting pencil may make a record on the cylinder. The first hygrometer properly so-called was made by Professor Daniell. It consists of a glass tube, bent at right angles into arms of unequal length. Each arm terminates in a bulb, one bulb (usualy black) being two-thirds filled with sulphuric ether, and the other bulb being, at the commencement of an experiment, empty. In process of construction the tube is exhausted of air, and is thus filled with vapor of ether through its entire length. A thermometer with a bulb immersed in the ether of the lower arm is inserted in the tube to register variation of temperature, and a second thermometer is attached to the stand of the instrument to show the temperature of the outer air. For use one bulb containing the sulphuric ether has a zone of polished gold, and the other bulb a muslin cover. If sulphuric ether be dropped on the latter, as it evaporates the bulb is cooled, and the vapor of ether is condensed within it from the other bulb; the temperature of which rapidly falls owing to evaporation from it. The operation is carried on, ether being dropped on the second bulb as is required, till the temperature of the first is so far reduced that dew from the surrounding air just begins to condense upon it. By means of the thermometer contained in the first bulb the temperature is read off at the instant at which vapor begins to condense, and the dew-point is thus obtained. The hygrometric condition, that is, the ratio between the quantity of moisture that the air actually contains and the quantity which it is capable of containing at the existing temperature is then easily deduced.



Regnault's Hygrometer

Regnault's hygrometer, shown in the above figure, is an important modification of Daniell's instrument. D and D′ are two precisely similar cups or thimbles of polished silver; each is surmounted with a similar glass tube into which, by means of a cork, two thermometers are fitted, and the bulbs of the thermometers are covered with ether. Through the cork in one of the tubes a small glass tube *t* passes, and is carried down below the surface of the ether; while a side tube establishes communication with the vertical tube U V which is connected with an aspirator A (or vessel into which air is sucked at the top to supply the place of water which escapes at the bottom). There are no corresponding side tubes connecting the left-hand tube of the hygrometer D′. By means of the aspirator a current of air is drawn through *t*; it therefore bubbles through the ether, causing evaporation and cooling the ether till the dew-point is reached. This is observed with great nicety by means of a silver cap; for the instant the dew commences to deposit, the brilliant polish of the silver is dulled. The temperature of the air is at the same time read off by means of the other thermometer in D′. Regnault's hygrometer, both from its construction and from the use of the aspirator, avoids the too great proximity of the observer, which from the nature of the experiments, is objectionable.

Mason's dry and wet bulb hygrometer (sometimes called psychrometer or hydrodeik) consists of two thermometers arranged side by side as in the figure. The dry bulb gives the temperature of the air at the time of observation; and the other bulb, which is covered with muslin, and kept moist by filaments of cotton carried from it into a small cistern of rain or distilled water, reduces the height of the mercury in its tube in proportion to the capacity of the air for drying or taking up additional vapor. This instrument does not give the dew-point directly. The difference between the readings of the two thermometers is multiplied by a special factor for every temperature of the dry bulb. The United States Weather Bureau psychrometer has two thermometers mounted parallel on a jointed handle that permits their being whirled. One thermometer bulb is covered with wet muslin, the other exposed to the air; the difference in the record of the two thermometers is greater as the air is drier.

HYKSOS, hĭk'sōz, according to the Egyptian annals, a conquering nomadic race from the East, who, under Salatis, their first king, took Memphis and rendered the whole of Egypt tributary. Their name probably means "foreign kings," the explanation "shepherd kings" being of later origin. The date of their invasion and conquest was about 1700 B.C., of their expulsion about 1600 B.C. The seat of their rule was the strongly garrisoned fortress of Avaris, on the northeastern border of the Delta. They followed Egyptian customs, and their six monarchs took Egyptian names. It seems likely also that a great part of Syria was subject to them. The only detailed account of them in any ancient writer is an unreliable passage of a lost work of Manetho, cited by Josephus in his rejoinder to Apion.

HYLAS, hī'las, a character in Greek legend. He was the son of Theiodamus, king of the Dryopians in Thessaly, and accompanied Hercules on the Argonautic expedition. When they stopped in Mysia near the mouth of the Kios, Hylas went to a certain spring to draw water. The nymphs of the spring drew him down into the depths, and he was lost. The loss of his favorite grieved Hercules greatly, and he threatened to ravage the land of Kios unless Hylas was found. Therefore a day was fixed on which the inhabitants of the island wandered about the country calling the lad's name. The story as it has come down to us is doubtless a later treatment of an old Greek legend.

HYLIDÆ, the tree-frog family. This is the fourth family of the *Anura,* or tail-less amphibians and is nearer in its relations to the toads than to the typical frogs (*Ranidæ*). Its members are of comparatively small size and arboreal habits. Technically the family is characterized by an arciferous sternum, sacral diapophyses, teeth in the upper jaw, and the terminal phalanges of the fingers elongated, claw-shaped and swollen at the base, and bearing adhesive discs. This disc is a cartilaginous pad situated between the terminal phalanx and the one preceding it, the muscular contraction of which in action produces one or more furrows on its under side. It is rich in mucilaginous glands on the surface, and enables the frog to cling to the vertical surfaces, as tree-trunks, where it customarily perches, by the combined effect of pressure and stickiness, for no suction is applied, and the assistance of the clawed toes where the surface is rough. The hylidæ dwell in all the warmer and forested parts of the world except Africa, and have extraordinary breeding habits. The hylidæ are almost exclusively American, a few species in Australia, two in China, and the widely distributed *Hyla arborea* of Europe being the only exceptions. The centre of the family is tropical America, where about 100 species have been listed. See Tree-frog.

HYLLESTED, hül'lę-sted, **August,** Swedish pianist: b. Stockholm, Sweden, 1858. He began his musical education at a very early age, making his first public appearance in 1863. He was sent to Copenhagen to study under Holger Dahl, where he remained until 1869. He then toured Scandinavia and subsequently spent some years at the Royal Conservatory of Copenhagen. His next connection was as organist of the cathedral and director of the musical society in the same city. In 1879 he went to Berlin, where he studied under Kullak and Kiel. Later he had Liszt as a teacher, and began his various concert tours. He was enthusiastically received in the musical centres of the United States, where he was assistant director of the Chicago Musical College (1886–91) and director of the piano department of the Gottschalk Lyric School (1891–94). After a year's tour in Europe, he made his home in Chicago. He has composed a number of very fine songs and piano selections.

HYLOBATES, an anthropoid ape of the Gibbon group. See Gibbon.

HYLOGLYPHS, small wooden tablets, found on Easter Island (q.v.) carved with conventionalized figures. Twelve of these have been preserved. In spite of persistent efforts, the picture writing has not yet been translated satisfactorily. They are chiefly important as the one specimen of an attempt at writing on the part of the South Sea Islanders, except for a rarely used syllabary discovered in 1914.

HYMANS, Solomon Louis, loo-ē ē-män, Belgian historian, journalist, novelist and poet: b. Rotterdam, 1829; d. Brussels, 22 May 1884. He removed to Belgium in boyhood and rose rapidly to distinction as a Liberal journalist. He edited the Belgian *Star* and the Parliamentary *Echo* for some years, and was elected to Parliament in 1859. He wrote 'History of the Marquisate of Anvers' (1848); 'Popular History of Belgium' (1860); 'Political and Parliamentary History of Belgium' (1869–70); 'Notes and Souvenirs' (1876); 'Types and Silhouettes' (1877); 'Brussels Throughout the Ages' (1883–89); two popular novels, 'André Bailly' (1861) and 'The Buvard Family' (1858); and some pleasing poems.

HYMEN, the god of marriage in Grecian mythology; originally the Greek name of the marriage song. The common legend is that he is the son of Apollo. No marriage took place without his being invoked to sanction it. He is described as having around his brows the flower of marjoram, in his left hand the flame-colored nuptial veil, and in his right the nuptial torch.

HYMENOPHLLACEÆ. See Ferns and Fern Allies.

HYMENOPTERA, hī-mĕn-ŏp'tĕ-ra, an order of Hexapoda or insects, considered by many entomologists to be the highest and most perfect expression of the insect type. The metamorphosis is complete and extensive. The larvæ are short, thick grubs, footless except in the saw-flies (*Tenthredinidæ*) and in most cases are carefully nurtured and fed in nests. The pupæ have nearly the form of the perfect insects. The imagos are of compact, highly complex construction, with the three regions well marked, except that the first segment of the abdomen is united with the thorax. A considerable part of the large head is occupied by the conspicuous compound eyes, besides which there are three ocelli. The jaws or mandibles are conspicuous biting organs, and the remaining mouth-parts usually form more or less of a proboscis with a large ligula or tongue. Although the wings are small, they move with great rapidity and sustain the body in rapid and extended flight; there are two pairs (usually), membranous, veined and transparent. The hymenoptera are divided by Linnæus into two sections, the *Terebrantia,* which have an ovipositor instead of a sting in the female, and the *Aculeata* whose females have a sting. A more generally accepted division regards the saw-flies as a primitive sub-order, having no waist or constricted region at the middle, and an incomplete union of the first abdominal segment with the thorax, and also having thoracic and often abdominal legs in the larval stage.

Marked sexual dimorphism is very frequent especially among the social forms, in which a third class of individual, the worker or neuter, in reality imperfect females, also occurs. Many of the ant communities are still farther polymorphic. The order is one of great extent and exceptional interest, as it includes the ants, bees and wasps, the ichneumon-flies, gall-flies and saw-flies, divided into numerous families. Among the ants and bees are exhibited most remarkable and complex social states, which are described in the articles on these groups. The habits of the numerous species of wasps, and especially the varied architecture of their nests, are of nearly equal interest. A remarkable series of adaptations to special conditions are presented by the parasitic ichneumon flies and their allies, which lay their eggs within the bodies of the larvæ or even in the eggs of other insects, on the substance of which their own larvæ feed. Confining their parasitism to plants, the gall-flies produce by the irritation caused by their eggs or secretions deposited with them in the tissues of leaves, twigs or fruits, the familiar excrescences whose shapes are almost as numerous as the species which produce them. (See GALLS). Finally, the saw-flies are least typical of the order but stand nearest to the main hexapod stem. Their larvæ have both thoracic and abdominal legs and closely resemble caterpillars; they are vegetarians and many of them are very destructive to plants. Consult standard works of Entomology (see INSECTS), and the bibliographical list given by L. O. Howard in the appendix to his 'Insect Book' (New York 1902).

HYMETTUS, a mountain range in Attica, about 3,500 feet high, about five miles southeast of Athens. Its honey has been famous since ancient times. Its extensive quarries produced a bluish marble, often used for buildings and sculpture; but the white marble was considered superior.

HYMNOLOGY. A hymn is the expression of praise to God, designed to increase the reverence and arouse the devotion of a worshipper, and is often the vehicle of prayer. It is usually expressed in lyric verse, but not always. Some hymns are designed to be recited and not sung and are in prose. This is especially true of some Buddhist hymns.

From the beginning of history music and poetry have gone hand in hand. When men turned to worship they endowed it with music and poetry. They gave of their best. The early religions used songs of incantation approaching some of the Psalms of the Old Testament. The incantations from the Assyrian and Babylonian religions are of this character. The Egyptian religion also furnished some specimens. A hymn to the Nile used by its ancient worshippers seems almost like a Psalm. The Buddhist hymns are more like meditations. Ancient Greece was the land of song and all sorts of events were celebrated in poetic setting. Many splendid productions have come to us from the devotees of many religions. The non-Christian world has not known much of congregational singing. That has been peculiar to the Jewish and Christian religions.

The Old Testament contains many hymns finding their culmination of excellence in the Book of Psalms, which has set a standard for all succeeding years. The songs of Moses, Miriam, Deborah and Hannah, and the lament of David over Jonathan should be mentioned. The temple worship is said to have required great choruses, as many as 12,000 men singing antiphonally at a single service. The volume of sound was so great that it could be heard 12 miles away.

The New Testament furnishes several specimens of early Christian hymns. The first and second chapters of the Gospel of Luke contain the *Gloria in Excelsis*, the *Magnificat*, the *Benedictus*, the lesser *Benedictus* and the *Nunc Dimittis*, early expanded and used in the worship of the church. Other remains of early Christian hymnody are found in Acts iv, 24–30; Ephesians v, 14; 1 Timothy vi, 15, 16; 2 Timothy ii, 11–13; Revelation i, 4–8; v, 9, 10, 12–14; xi, 15, 17, 18; xv, 3, 4; xxi, 10–14: xxii, 17. There are traces of the very early use of these passages as hymns by the church.

The church of the post-Apostolic age was a singing church. Origen tells us of a Christian hymnbook, now lost, called 'The Psalterium.' Pliny's letter to Trajan proves the use of song in worship. The oldest Christian hymn known is one credited to Clement of Alexandria, and probably composed about the year 200. Henry M. Dexter has given a free paraphrase of it in his 'Shepherd of tender youth' widely used in many hymnals. Other paraphrases are also in use. The candle lighting hymn, preserved by Saint Basil, is probably of very early origin. Julian notes 11 metrical translations of this hymn in addition to the prose rendition of Cardinal John Henry Newman.

The Eastern or Greek Church had many hymn writers of note. Methodius, who died about 311, has a hymn in his 'Banquet of Ten Virgins.' The *Ter Sanctus* was a hymn in use before the year 400. Gregory of Nazianzen and Anatolius were noteworthy writers of hymns. With Saint Andrew of Crete began a series of noteworthy hymn writers. Modern hymnals use translations of several of his hymns. Saint John of Damascus, Saint Cosmas and the poets of the Studium are the most noteworthy writers in the 200 years ending about the year 800. Bardesanes, a Gnostic leader, has sometimes been called the father of hymn-writing. His hymns were so popular that Ephrem Syrus wrote new hymns to replace them and thus became the father of hymnody in the Syrian Church.

Saint Hilary of Gaul, Bishop of Poitiers, was the father of hymnody in the Latin Church. Pope Damasus I wrote two hymns. With Ambrose of Milan a new era begins in Latin hymnody. He composed several hymns used in later service books. In the period from the 4th to the 11th century only a few names are worthy of note. Aurelius Clemens Prudentius, born in Spain in the last half of the 4th century, was a writer of many hymns. Cœlius Sedulius composed a hymn in acrostics and several others. Venantius Honorius Clementanus Fortunatus was one of the greatest of the Latin hymn writers (d. 609). The next group contained Peter Damiani, Boniventura, Bernard of Cluny, Bernard of Morlaix, Notker Thomas of Celano, Adam of Saint Victor, and other writers. This is sometimes called the Golden Age of Latin hymnody. The Anglo-

Saxon Church produced the Venerable Bede, its historian and also the father of English learning and English hymnody. Dr. Philip Schaff divides German hymn-writing into six periods: the period previous to the Reformation; the Reformation, 1520–1648; the Confessional Period, 1618–80; the Pietistic and Moravian Period, 1680–1757; the Rationalistic Period, 1757–1817; the Modern Period, including the last 100 years. Martin Luther was the father of German hymnody and German church music. His hymns were sung all over Germany and his opponents declared that his hymns "destroyed more souls than his sermons." Justus Jonas Alber, Nicholas Hermann and Michael Weiss of the Reformation group also contributed to the growth of the Lutheran movement by their hymns. The first German Evangelical hymnbook appeared in 1524 and because it contained only eight hymns was entitled 'Achtliederbuch.'

During the period of the Thirty Years' War several noted poets lived, including Martin Opitz and Michael Altenburg. The lätter was the author of the first three verses of the battle hymn of Gustavus Adolphus. The Golden Age of German hymn-writing is in the third period, and found its culmination in Paul Gerhardt (1607–76), a Lutheran pastor in Berlin and Lübben. Johann Franck and Sebastian Michael and Peter Franck, Johann Rist, George Neumark and Michael Schirmer are only a few of the names of the more prominent hymn composers of the period.

In the fourth period, Philip Jakob Spener and August Hermann Francke were the leaders among the Pietists in hymn-writing. The son-in-law of Francke, Johann A. Freylinghausen, is said to have produced the best hymn book of the movement. The list of Pietist hymn composers is a long one. In the Moravian movement Nicolaus Ludwig Graf von Zinzendorf was the author of 2,000 hymns. Of these 205 have been translated into the English language, largely by John Wesley, Mrs. Charles and Miss Jane Borthwick. The Count's second son was also a hymn composer. August Gottlieb Spangenburg, who resided in America for many years, composed three noteworthy hymns.

The German Reformed Church produced Joachim Neander, Friedrich Adolf Lampe and Gerhard Tersteegn, writers of hymns of the first rank.

In the fifth period, Christian F. Gellert, Friedrich Gottlob Klopstock (called the German Milton), J. C. Lavater, Matthias Jorissen and Matthias Claudius were the chief hymn writers.

In the modern period there is a long list of writers of note, including Ernest Moritz Arndt, the Krummachers, father and son, Friedrich Rückert, Albert Knapp, C. G. Barth, Johann Peter Lange, K. J. P. Spitta and Karl Gerok.

French hymnody received a contribution from Jean Racine, and his four paraphrases are still in use. Some portions of the poems of the poet Pierre Corneille have been used as hymns. Fénélon composed a few hymns. Madame Giuyon composed nearly 900 pieces which were set to the music of popular tunes of the day. The Huguenots produced nine small books of *Chansons*, 1532–97. A selection from these was published by Henri Bordier in Paris, 1871.

John Calvin wrote a few hymns. The psalter of Clement Marot and Beza's psalter were used in the Reformed Church until 1705, when a supplement containing a few hymns by Benedict Pictet was added. Cæsar Malan (1787–1864) was the greatest of all the French hymn writers. He compiled 'Chants de Sion,' 1841, to which he contributed several hymns, some of which have been widely used. Later hymn composers include Ami Bost. H. Empaytz, Guers, Galland, and Dr. J. H. Merle d'Aubinge, the historian of the Reformation. In 1834 M. Henri Lutteroth issued 'Chants Chretiens,' which included 44 from his own pen, and contributions were included from Alexander Vinet, Adolphe Monod and other leaders.

Scandinavian hymn-writing dates from the introduction of Lutheranism. Two brothers, Olaf and Lars Petersen, were the first leaders. Olaf had been a pupil of Luther and Melancthon at Wittemburg. Two other brothers, Lawrence and Peter Anderson, were the next noteworthy hymn-writers. The first hymnary of Norway and Denmark was published at Malmo in 1528 by Claus Martensen Tondebinder; Thomas Kingo, a poet of ability revised it. Gruntvig, the great Danish scholar, exercised a profound influence on the character of Danish hymnology, giving it a more spiritual trend.

Ireland does not possess a distinctive hymnody of its own. Wales is a land of song and has produced some noteworthy hymns. In Scotland the early history of hymnology deals almost entirely with metrical versions of the Psalms. The earliest version is sometimes known as the 'Dundie Psalmes,' 1578. The first edition may have been published before the year 1546. The first Scottish Psalter properly so called was issued in 1564. Some of the versions were made by the Scottish and other exiles in Geneva. The Westminster Assembly authorized a new edition which was published in 1650. Later the General Assembly, not satisfied with the Westminster version, authorized other psalters and paraphrases. 'The Scottish Psalter' was prepared by a committee and sanctioned by the General Assembly. The Baptists, Congregationalists, United Presbyterians, Free Church, and Scottish Episcopal Church have each issued a series of hymnals.

The hymnody of England, as in Scotland, had at the beginning only versions of the Psalms. Thomas Sternhold, who was groom of the robes to Henry VIII, was scandalized at the songs sung at court, and that something better might be sung translated 51 Psalms into English metre. The first published edition contains 19 Psalms. A second edition published n 1549 contained 37. The third edition of 1551 included seven additional versions by John Hopkins, and henceforth it was called 'Sternhold's and Hopkins' Psalms.' Next followed the 'Geneva Psalter' of 1558, mentioned above. In 1562 'The Complete Psalter' of Sternhold and Hopkins was published by John Daye. It influenced largely the worship and hymnology of England for a long time. A new version by Nicholas Brady and Nahum Tate appeared in 1695–96. Later many English writers tried their talents in making versions of the Psalms. Julian lists 326 distinct versions.

Isaac Watts has been called the father of English hymn-writing. He is so in a qualified sense. John Donne and George Herbert wrote hymns, and there were occasional hymns written by others before the first hymn-book, 'Hymns and Songs of the Church,' was issued in 1623 by George Withers. Then followed hymn-books by Robert Herrick, Henry Vaughan, Jeremy Taylor, Samuel Crossman, John Austin, John Mason, and Benjamin Keach, besides the many individual hymns of merit including the three unsurpassed hymns of Bishop Thomas Ken. Nevertheless, Watts (q.v.) occupied a large place as a hymn composer. Philip Doddridge soon followed him. Then came the Wesley brothers, John, Charles and Samuel, all poets and sons of a poetical father. Samuel Wesley, Jr., left a volume of poems. Six of his hymns are in common use. John and Charles Wesley issued jointly or singly no less than 64 hymnbooks. The first one was issued at Charleston, S. C., in 1736, and the last at London in 1786. They were gathered by Rev. George Osborn, and published in 13 volumes as the 'Poetical Works of John and Charles Wesley.' John Wesley translated many hymns. Charles Wesley was the author of more than 6,000 hymns. More than 500 hymns of John and Charles are in common use to-day in various hymnals. The Wesleys influenced many followers. There were Thomas Olivers, John Cennick, William Hammond, Edward Perronett, Joseph Hart and Robert Robinson among the Methodists; John Newton, William Cowper, R. Madan, R. Conyers and R. De Courcy of the Evangelical party of the Church of England. They even inspired their opponents, one of the chief of whom was Augustus Montague Toplady, author of 'Rock of Ages.' The Congregationalists were likewise influenced by the movement. Rowland Hill, Ralph Wardlaw and John Dobell each issued hymnbooks.

James Montgomery, a Moravian, was the next great hymn-writer. Seventy-one of his hymns are still in common use. Mrs. Barbauld (1772) and Anne Steele (1760) were among the first women to write hymns. Twenty-one by Mrs. Barbauld are in common use, while 75 of Miss Steele's 144 hymns are still sung. Henry Kirk White should not be omitted from this period. He composed only 10 hymns, but they are all in common use. Reginald Heber wrote some of the greatest and best beloved hymns of the Church.

The Oxford or Tractarian movement produced a notable group of hymn-writers: John Henry Newman, Edward Caswell, Frederick W. Faber and John Keble. Some of their hymns are among the greatest in the language.

Space forbids the mention of the great host of English hymn-writers. We can only mention a few of the most outstanding ones who have appeared since the Tractarian movement. John Mason Neale (1818–66) has rendered a great service to the English-speaking world in his translation of hymns of the Eastern Church. John S. B. Monsell, Sir Henry Williams Baker, Henry Frances Lyte, Sir John Bowring, Francis T. Palgrave, Henry Alford, Mrs. C. F. Alexander, Charlotte Elliott, Frances Ridley Havergal and Sarah Flower Adams must not be omitted. George Matheson, the blind preacher of Endinburg, gave us 'O love that will not let me go,' a great hymn destined to live.

The first book used in worship in America was 'The Bay Psalm Book,' or New England Version, first published by Stephen Day in 1640. It is supposed that "no less than 70 editions were printed." It was superseded first by the version of Tate and Brady and next by that of Isaac Watts. Hymn writing did not begin until after the War of the Revolution. Some of the most important American hymn-writers are Timothy Dwight, Bishop George W. Doane, Bishop H. U. Onerdonk, John Pierpont, William Cullen Bryant, Phœbe Cary, Samuel Occum, J. W. Alexander, Thomas Mackellar, Samuel F. Smith, Fanny Crosby, the most prolific of all American hymn-writers, Anna Warner, Frank Mason North, Bishop Arthur Cleveland Coxe, and all of our great American poets, besides a long list of minor writers.

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One Hundred Widely Used Hymns.

Abide with me; fast falls the eventide.— H. F. Lyte.
A charge to keep I have.— Charles Wesley.
A few more years shall roll.— H. Bonar.
All hail the power of Jesus' Name.— E. Perronet.
All people that on the earth do dwell.— W. Kethe.
A mighty fortress is our God.— Martin Luther.
Art thou weary, art thou languid.— Stephen the Sabaite.
Awake my soul and with the sun.— Bishop T. Ken.

Be strong, we are not here.— M. D. Babcock.
Blest be the tie that binds.— J. Fawcett.

Children of the heavenly king.— J. Cennick.
Christ, the Lord is risen to-day.— Charles Wesley.
Come O thou traveller unknown.— Charles Wesley.
Come thou fount of every blessing.— Robert Robinson.
Come ye sinners poor and needy.— Joseph Hart.

Fairest Lord Jesus.— From the German.
Faith of our fathers living still.— F. W. Faber.
Fear not O little flock the foe.— Altenburg.
For all the saints who from their labor rest.— W. W. How.
Forever with the Lord.— James Montgomery.
For thee, O dear, dear country.— St. Bernard of Cluny.
Forward be our watchword.— Henry Alford.
From Greenland's icy mountains.— R. Heber.

Glory to Thee, my God, this night.— Bishop T. Ken.
God be with you till we meet again.— J. E. Rankin.
God calling yet shall I not hear.— G. Tersteegen.
God moves in a mysterious way.— W. Cowper.
Guide me, oh thou great Jehovah.— William Williams.

Hail thou once despised Jesus.— J. Bakewell.
Hark, Hark, my soul, angelic songs are swelling.—F. W. Faber.
Hark the herald angels sing.— Charles Wesley.
Hasten, Lord, the glorious time.— H. Auber.
He leadeth me! Oh blessed thought.— Joseph Gilmore
Holy, Holy, Holy, Lord God Almighty.— R. Heber.
Holy Spirit, faithful guide.— M. M. Wells.
How firm a foundation.— G. Keith.
How gentle God's command.— P. Doddridge.
How sweet the name of Jesus sounds.— John Newton.

If on a quiet sea.— A. M. Toplady.
I heard the voice of Jesus say.— H. Bonar.
I love Thy kingdom, Lord.— T. Dwight.
I need Thee every hour.— Mrs. A. S. Hawkes.
In the cross of Christ I glory.— Sir John Bowring.

Jerusalem my happy home.— F. B. P. and J. Montgomery.
Jerusalem the golden.— St. Bernard of Cluny.
Jesus and shall it ever be.— Joseph Gregg.
Jesus calls us o'er the tumult.— Mrs. Alexander.
Jesus lover of my soul.— Charles Wesley.
Jesus shall reign where'er the sun.— Isaac Watts.
Jesus the very thought of Thee.— St. Bernard.
Just as I am without one plea.— Charlotte Elliott.

Lead kindly light amid the encircling gloom.— J. H. Newman.
Lead on, Oh king eternal.— E. W. Shurtleff.
Lift your glad voices in triumph on high.— H. Ware, Jr.
Lord dismiss us with thy blessing.— J. Fawcett.
Lord I hear of showers of blessings.— Elizabeth Codner.
Lord in the morning thou shalt hear.— Isaac Watts.
Lord of all being, throned afar.— O. W. Holmes.
Love divine, all loves excelling.— Charles Wesley.

More love to Thee, oh Christ.— Mrs. E. P. Prentiss.
My faith looks up to Thee.— Ray Palmer.

Nearer, my God, to Thee.— Sarah Flower Adams.
Now thank we all our God.— M. Rinkart.

Oh day of rest and gladness.— C. Wordsworth.
Oh for a closer walk with God.— W. Cowper.
Oh for a heart to praise my God.— Charles Wesley.
Oh for a thousand tongues to sing.— Charles Wesley.
Oh God, our help in ages past.— Isaac Watts.
Oh Jesus I have promised.— J. E. Bode.
Oh little town of Bethlehem.— Phillips Brooks.
Oh love that will not let me go.— George Matheson.
Oh Paradise! Oh Paradise!— F. W. Faber.
Oh sacred head once wounded.— St. Bernard.
Oh worship the king all glorious above.— R. Grant.
One more day's work for Jesus.— Anna B. Warner.
One sweetly solemn thought.— Phoebe Cary.
Onward Christian soldiers.— S. Baring-Gould.

Rescue the perishing.— Fanny Crosby.
Rock of Ages, cleft for me.— A. M. Toplady.

Safe in the arms of Jesus.— Fanny Crosby.
Saviour again to Thy dear name we raise.— J. Ellerton.
Saviour breathe an evening blessing.— James Edmeston.
Sun of my soul Thou Saviour dear.— John Keble.
Soldiers of Christ arise.— Charles Wesley.

Take my life and let it be.— Frances Ridley Havergal.
Tell me the old, old story.— Mrs. Hankey.
The Church's one foundation.— S. J. Stone.
The King of love my shepherd is.— H. W. Baker.
There is a fountain filled with blood.— W. Cowper.
There is a green hill far away.— Mrs. Alexander.
There is a land of pure delight.— Isaac Watt.
The Son of God goes forth to war.— R. Heber.
The spacious firmament on high.— Joseph Addison.

We may not climb the heavenly steeps.— J. G. Whittier
When all Thy mercies, O my God.— Joseph Addison.
When I survey the wondrous cross.— Isaac Watt.
Where cross the crowded ways of life.— F. M. North.
While shepherds watched their flocks by night.— N. Tate.
Work for the night is coming.— A. L. Coghill.

Zion stands with hills surrounded.— T. Kelly.

HYMNS. See Hymnology.

HYMNS, Latin. From the beginning, the Church adopted the psalms and made use of various versicles and devotional hymns in its service. Once the persecutions ceased, and Christians had no longer to hold their services so as to avoid notice, this practice grew in significance. The great Fathers of the Church wrote or encouraged the writing of hymns, and by the end of the 4th century a large number were in use. Hilarius Pictaviensis, Hilary of Poitiers (died 368), made a collection of hymns with the title, ‘Liber Mysteriorum,’ mentioned by Saint Jerome, now lost, for which he has been called the Father of Western Hymnology. Some of the hymns of Pope Damasus (died 384) whose secretary Jerome was, have been preserved. The greatest hymn writer of the 4th century is Saint Ambrose. Not all the hymns attributed to him are his, but many are, and one at least, the ‘Te Deum,’ is still in common use. Among the other great hymn writers of the earlier centuries are Saint Augustine, Prudentius, Sedulius (an Irishman of the 5th century), Fortunatus, and Eugenius (of the 6th and 7th centuries), Pope Gregory the Great, Venerable Bede, Alcuin, (8th century), and Peter Damien (died 1072). It is the latter part of the Middle Ages, however, especially the 12th and 13th centuries, that saw the birth of the greatest Latin hymn writers. They are Bernard of Clairvaux and Bernard of Morlaix, Adam of Saint Victor, and Alanus of Lille, of the 12th century, and Thomas of Celano, Bonaventure, Aquinas, and Jacopone da Todi of the 13th century.

At first these hymns in the Western Church were written in the meters of the old Latin poets, but after the introduction of rhyme, they gradually came to follow the new mode. In the earlier Middle Ages an essential change took place in the pronounciation of Latin. “Quantity and pitch were used for accents and emphasis in the early Latin; stress or loudness of sound gradually took their place and the meters changed at the same time. In the Augustan poetry, the arsis is laid on the long syllables, in the later Latin poetry, on accented syllables. . . . In the Latin hymns, the change from one system to the other can be noted. As modern poetry is founded on accents, not quantity, it is in these Latin hymns that can best be studied the gradual rise of modern poetry.” (March). The Latin hymns are also of interest because in them can be studied the progress from alliteration to rhyme. At first, the regular recurrence of a vowel sound at regular intervals, made the music of verse. After a time, the addition of similar consonant sounds added to the musical quality and the satisfaction to the ear, and then rhyme as we now know it was complete. The various stages between the two can be recognized and excellent illustrations of the various phases obtained in the larger collections of Latin hymns.

The language of the early hymns is the common speech of the day, colored by Bible idioms. New words appear but only such as are needed for new thoughts. Familiar words are lifted to the standard of poetic diction by application to Christian usage. An extreme simplicity of language just as far as that is compatible with the expression of the profound devotional truths of Christianity characterizes them. They are much simpler than classical Latin poetry, and for that reason deeply influenced popular devotion and thinking and served to modify popular language and poetry. In the history of literature, the Latin hymns occupied an important place because they were the first original poetry of the people in the Latin language. The Latin poetry of the classical period was an echo of Greece “both in substance and form, the matters and meters were both imitated and the poems were composed for the lovers of Grecian art in the Roman court. It did not spring from the people and it never moved the people, but the Christian hymns were proper folk-poetry, the 'Bible of the people'— their Homeric poems.» (March). It was their use by the people that fostered rhyme in the poetry of the modern languages. The folk listened to these Latin hymns sung on the festival days many times every year, (they were required to go to church nearly 100 times a year), became familiar with the cadence of them, and the music of verse, often joined in using them at the time when the modern languages of Latin origin were coming into existence, and these hymns therefore constituted the school in which modern rhymed poetry took its rise.

The supreme place among the Latin hymns is universally accorded to the 'Dies Iræ' (q.v.), written by one of the early Franciscans. Professor Saintsbury says: «There is not likely to be ever lack of those who, authority or no authority, in youth and in age, after much reading or without much, . . . will hold these wonderful triplets, be they Thomas of Celano's or another's, as nearly or quite the most perfect wedding of sound to sense that they know.» This enthusiastic recognition has been shared by Crashaw, Jeremy Taylor, Dr. Johnson, Goethe, the Schlagels, Dryden, Scott, Villemin, Trench, Macaulay, and a host of similar persons of ability. Just after the 'Dies Iræ' comes the 'Stabat Mater' (q.v.), written very probably by another of the early Franciscans, Jacopone da Todi. Schaff declares: «It is the most pathetic, as the 'Dies Iræ' is the most sublime hymn of the Middle Ages, and occupies the second rank in Latin hymnology.» It has inspired some great musical compositions by the most famous composers. The five other greatest of the Latin hymns constituting an immortal septet are the 'Ad Regias Agni Dapes,' probably written by Saint Ambrose, surely coming from his time; the 'Vexilla Regis,' an unrhymed hymn usually said to have been written by Fortunatus in the 6th century; the 'Jesu Dulcis Memoria' of Saint Bernard of Clairvaux written in the 12th century; the rhythm of Bernard de Morlaix or Bernard of Cluny, a contemporary of Saint Bernard, and finally the 'Pange Lingua Gloriosi' (q.v.), of Saint Thomas Aquinas. There are many other hymns urged by admirers for the place in this list of honor, but those given are surely the favorites. Neale says that Aquinas' 'Pange Lingua' «contests the second place among the hymns of the Western Church with the 'Vexilla Regis,' the 'Stabat Mater,' and the 'Jesu Dulcis Memoria,' . . . leaving the 'Dies Iræ' in its unapproachable glory.» It is a supreme surprise to find the greatest scholar of his time possessed as so many think with the greatest human mind after that of Aristotle, thus placed among the greatest of poets, for it is generally recognized that these hymns are among the greatest poetry ever written, unsurpassed and never equalled except by Dante and Shakespeare. (Saintsbury). The loving devotion with which these hymns were written can be very well appreciated from the rhythm of Bernard of Morlaix, out of which a number of the modern hymns on 'Jerusalem the Golden' were composed. It is written in hexameters following rather strictly the old prosody, but there are two internal sub-rhymes in each line and the lines rhyme as couplets. The difficulties of the task must have been enormous but they have been marvellously overcome and have only served to enhance the beauty of the hymn. Schaff, in his 'Christ in Song' says: «This glowing description is the sweetest of all the Jerusalem hymns of heavenly homesickness,» and Dr. Neale says that «it is the most lovely as the 'Dies Iræ' is the most sublime and the 'Stabat Mater' the most pathetic of mediæval poems.» Rhyme and metre shackles only make the poet dwell on his theme so thoroughly that his thought has been a fount of devotion all down the ages.

After the beauty of the Latin hymns, their most wonderful feature is the admirable critical faculty, which served to recognize and preserve to posterity so many precious gems of religious poetry, though there must have been at all times, as has been so true in ours, so many counterfeit imitations of mere sentimentality and not true poetry.

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JAMES J. WALSH.

HYMNS, National. See NATIONAL HYMNS.

HYMNS OF HATE, two German metrical effusions composed in 1914 and 1915 by Ernst Lissauer and a man named Hochstetter. That of the former, 'Hassgesang gegen England' consists of three long stanzas, each ending with «We (or They) have but one enemy — England!» The other has four shorter stanzas each concluding with «God punish England!» This gave rise to a popular expression in Germany of «Gott strafe England!»— a phrase attached to salutations, stamped on medals and for a time printed on little stamps and paper money. Lissauer's «Hymn» was translated into English and sung in London music-halls — the audiences joining in the chorus. Consult Gerard, J. W., 'My Four Years in Germany' (pp. 218 and 308, New York 1917). For translations consult *Current History* (New York February and April 1915); *New York Times* (15 Oct. 1914); *Public Opinion* (London 5 Feb. 1915).

HYNDMAN, hīnd'man, **Henry Mayers,** English Socialist and author: b. London, 7 March 1842. He was educated at Trinity College, Cambridge; and entered journalism. He was special correspondent for the *Pall Mall Gazette* in the war of 1866 between France and Italy, made a world tour 1869–71, and wrote leading articles in favor of free education in the Melbourne *Argus* in 1869. In 1881 he was one of the founders of the Social Democratic Federation, and has since been active in the Socialist movement, being the acknowledged leader of the Marxian Socialists in England. In 1884 he founded and edited the paper *Justice*. His works include 'Historical Basis of Socialism' (1883); 'Socialism and Slavery,' a reply to Herbert Spencer; 'The Commercial Crises of the Nineteenth Century' (Social Science Series, 1892); 'Economics of Socialism' (1896); 'The Future of Democracy' (1915); the autobiographical 'Record of an Adventurous Life' (1911); and 'Further Reminiscences' (1912).

HYPATIA, hī-pā'shĭ-ạ, Greek philosopher of the eclectic school, daughter of Theon, a celebrated astronomer and mathematician, who was at the head of the Neo-Platonic school in Alexandria early in the 5th century. Such was her reputation that she became a preceptress in the school of Plotinus at Alexandria, and expounded the principles of his system to a numerous auditory of students from all parts of the East. Her house became the resort of all the persons of learning and distinction in Alexandria, and, among others, of Orestes the Prefect, between whom and Cyril, patriarch of Alexandria, a conflict respecting authority existed. A fanatical mob, believing that Hypatia encouraged Orestes in his opposition to the patriarch, set upon and murdered her (March 415). Hypatia appears as the central figure of Kingsley's novel of the name (q.v.) 1853.

HYPATIA, or NEW FOES WITH AN OLD FACE (1853), is a striking and brilliant historical novel by Charles Kingsley. The scene is laid in Alexandria during the 5th centurn, A.D., and it is the story of a five-fold conflict among the Jews, the Roman authorities, Gothic invaders, Greek philosophers and Christian sectarians of a pronounced militant character. The main struggle is that between the attempt under the leadership of the gifted and beautiful Hypatia to restore to its former glory the ancient Greek pagan worship and philosophy and the counter efforts of the Christians under the leadership of Cyril to overcome both the Jews and the Greeks, as well as to make dominant their own power under the Roman government. They are successful to the extent of getting the upper hand of the Jews, of discomforting the Roman prefect and of murdering Hypatia, but their violence is shown in no amiable light. As in all of Charles Kingsley's important books, 'Alton Locke,' 'Yeast,' 'Westward Ho!' and others, genuine satisfaction lies only in the acceptance of a gentle, spiritual and charitable Christianity. This doctrine is most manifest in the final philosophy and triumph over Hypatia of the converted Jew, Raphael Aben-Ezra, and in the ultimate destiny of Philammon, a young monk, who, coming to Alexandria, passed through the various phases of the turbulent life of Alexandria and, rich in experience, spent his last days as a beneficent Christian abbot. The latter character is the real hero of the book in that his various experiences furnish the main thread for the presentation of the philosophical elements and political and spiritual conflicts of the novel; but Kingsley, in order to give a fuller account of contemporary affairs, is obliged to leave his hero from time to time and take the reader to witness such scenes as the defeat of Count Heraclian at Ostia or to visit with Saint Augustine and Synesius at Cyrene. The attempt is a panoramic account of the 5th century with, as is implied in the title, a very decided sermon in favor of spiritual Christianity.

William T. Brewster.

HYPERBOLA, a conic, the Cartesian equation of which, by a proper choice of axis, can be made of the form $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$. The x axis is called the transverse axis, and the y axis is the conjugate axis. The length of the transverse axis is said to be a, of the conjugate axis b. $\frac{x^2}{a^2} - \frac{y^2}{b^2} = -1$ is another hyperbola, known as the conjugate hyperbola of the first. The two lines $\frac{x}{a} = \pm \frac{y}{b}$ approach the hyperbola closer than any assigned limit, and are called the assymptotes of the hyperbola. The points $(\pm a \left(\frac{\sqrt{a^2+b^2}}{a} - 1\right), 0)$ are called foci, and have the property that the difference between the distances from a point on the curve to the two foci is constant. The ratio of the distance from a point on the curve from $(a\left(\frac{\sqrt{a^2+b^2}}{a} - 1\right), 0)$ to its distance from the line $x = \frac{a^2}{a^2+b^2}$ has the constant value $\frac{\sqrt{a^2+b^2}}{a}$. This latter value is called the eccentricity of the hyperbola, and is often written e, and the lines $x = \pm \frac{a^2}{a^2+b^2}$, are known as directrices. If $e = \sqrt{2}$, the hyperbola is said to be equilateral or rectangular, has perpendicular assymptotes and is congruent with its conjugate. A non-denegerate conic with the equation

$$Ax^2 + Bxy + Cy^2 + Dx + Ey + F = 0$$

is a hyperbola if $B^2 - 4AC$ is positive. A hyperbola is generated by the section of a cone by a plane which cuts both nappes, and accordingly consists of two infinite branches. Projectively considered, it is a conic with two real points at infinity. See Conic Sections.

HYPERBOLE, hī-per'bō-lē, a figure of speech. It consists in exaggeration for the purpose of making the object described more significant or striking. It is often employed in metaphors and similes.

HYPERBOREANS, hī-pĕr'bō-rē'ạnz, a mythical race, inhabiting a land beyond the Rhipæan Mountains. They were supposedly the bearers of sacrifices and gifts to Apollo, and were endowed with eternal youth. The name came to be applied ethnically to races of the Far North. Consult Roscher, 'Lexikon der griechischen und römischen Mythologie.'

HYPERIDES, hī-pĕr-ī'dēz, an Athenian orator: b. about 390; d. about 322 B.C. He studied philosophy and oratory, and began to practise at the law courts. His prosecutions of Autocles, an Athenian general, for treason; of Aristophon during the "Social War" (358–355 B.C.), and of Philocrates for high treason (343 B.C.), distinguished him as one of the leading public speakers of the time. His political sympathies led him to support Demosthenes (q.v.) and the democratic party. In the bitter struggle against Macedon, Hyperides equipped two triremes, and throughout was untiring in his patriotic zeal. When Demosthenes was accused of having been bribed by Harpalus, the treasurer of Alexander, the loyalty of Hyperides to his leader, long strained, snapped. He was chosen to lead the prosecution, and when the punishment of exile was inflicted on the head of the patriotic party, Hyperides was the choice of the people to fill his place. In the Lamian War against Antipater and Craterus, Hyperides was a conspicuous figure. His career came to an inglorious close at the decisive defeat at Crannon; and he was condemned to death with the other leading orators of Athens. His efforts at flight were unsuccessful. He was overtaken by the agents of Antipater and killed. As an orator, Hyperides was fluent, subtle and popular. He had the power of rendering his speeches simply and tactfully, and with a certain attractive grace and assurance that carried his audience invariably. Of the large number of speeches which have been attributed to Hyperides, about 50 are considered authentic. Research of the last century has brought to light a number of fragments, some of appreciable length. The funeral oration over the Athenians who had fallen in the Lamian War was unearthed at Thebes in Egypt. The speeches ‹Against Phillippides› and ‹Against Athenogenes› were edited by F. G. Kenyon (London 1893). There is a complete edition of all the literary remains of Hyperides with an ample bibliography, under the title ‹Hyperidis orationes sex cum ceterarum fragmentis› (Leipzig 1894). Consult Jebb, R. C., ‹Attic Orators› (Vol. II, London 1880); Blass, ‹Attische Beredsamkeit› (Vol. III, Leipzig 1898).

HYPERION, hī-pē'rĭ-ŏn, in Greek mythology, a Titan, son of Uranus and Ge, and father of Helios, Selene and Eos. Homer and later poets apply the name as a patronymic for Helios himself. The attribute of beauty has therefore been connected with the name, as in Shakespeare's comparison of «Hyperion to a satyr.»

HYPERION, in astronomy, the name assigned to the 7th satellite of Saturn, discovered in 1848, at the Harvard Observatory by G. P. Bond. It is outside the satellite Titan, whose mass causes perturbations in the orbit of Hyperion, which have proved to be a difficult problem in celestial mechanics, and a unique case in the solar system. They apparently give large eccentricity to Hyperion's orbit, and cause the apparent line of apsides to follow the conjunction points of Titan and Hyperion, in a direction contrary to the usual motion of this line.

HYPERION. ‹Hyperion,› a fragmentary epic in blank verse, published in 1820, was begun while Keats was caring for his dying brother and was continued during his struggles with grief and hopeless love. It is a fragment, yet a masterpiece. The theme, the triumph of the Gods over the Titans, is one of the most august in Greek myth, and the poem, in intensity of feeling and beauty of form, rises to its subject. The poem breaks off in the third book, leaving the hero, «blazing Hyperion,» still unconquered, facing the inevitable triumph of the young Apollo. But in its very incompleteness the fragment is perfect; to end it would have been to weaken it. For the Titans have fallen before «a power more strong in beauty.» In a poem that makes the old myth a symbol of the «eternal law» of the evolution of higher beauty, no such dramatic conflict as that of ‹Paradise Lost,› no such triumphant consummation as that of ‹Prometheus Unbound› is possible. Keats made one quickly abandoned attempt to recast the story. ‹Hyperion, a Vision› is but a groping beginning; but the noble lines recording the poet's search for the deeper vision born of suffering remain a poignant promise of the Keats that might have been. Shelley wrote: «If the ‹Hyperion› be not grand poetry, none has been produced by our contemporaries.» It is poetry of an unescapable grandeur. The random course of ‹Endymion› has given way to clear-cut structure; the romantic heroic couplet to a blank verse Miltonic in stateliness, lovely in melody; the misty fantastic scenes to imagery that is reality wrought of the poet's «natural magic.» And the conquered Titans are depicted with a nobility, a humanity that alone would place ‹Hyperion› at the height of the poetry of Keats. Consult Colvin, Sidney, ‹John Keats› (New York 1917); de Sélincourt, E., Introduction and notes in ‹The Poems of John Keats› (London); bibliography in ‹Cambridge History of English Literature› (Vol. XII).

Frances W. Cutler.

HYPERMETAMORPHOSIS. See Metamorphosis.

HYPEROPIA, hī-pĕr-ō'pĭ-ạ, a refraction of the eye which may be either acquired or congenital. When the refracting surfaces are not sufficiently convex, parallel rays of light converge on a point behind the retina, instead of on the retina, producing what is generally known as long-sightedness or hypermetropia. Hyperopia is the opposite refraction from myopia. See Vision, Defects of.

HYPERPYREXIA, hī-pėr-pī-rĕk'sĭ-ạ. See Fever.

HYPERSPACES. **Dimensionality.**— In order to make quite intelligible the concept variously denoted by such terms as hyperspace, space of higher dimensions or dimensionality, multi-dimensional space, n-space, n-fold or n-dimensional space, it is in the first place necessary to explain the meaning of dimensionality and to indicate the way in which the dimensionality, or number of dimensions, of a given space in a given element is determined or ascertained. Because, in order to determine the position of a *point* in a curve or straight line, it is necessary and sufficient to know *one* fact about the point, as, for example, its distance (with algebraic sign) from a fixed point or origin; a line is said to be a *one*-dimensional space of *points*. But instead of the point, we may choose for element of the space (line) a *pair* or a *triplet*, . . . or an *n-set* of points. In such cases, in order to determine the element, i.e., to pick it out or distinguish it from among all others of its kind, it is necessary and sufficient to know *two or three*, . . . or *n independent* facts about it. Hence a line is a *two-* or *three-*, . . . or n-dimensional space of *pairs* or *triplets*, . . . or *n-sets*, of points. In like manner a flat pencil (totality of lines of a plane that have a common point) is a *one*-dimensional space of *lines*; while its dimensionality is 2 in line pairs, 3 in *triplets*, and so on. For like reasons a plane is a *two*-dimensional space of *points* or of *lines*. In *circles* its dimensionality is 3, in *conics* 5, in *curves of third order* 9, and so on. It is at once seen that the dimensionality of a given space depends on the entity chosen for primary element, the element, i.e., in terms of which we elect to study and express the properties of the given space. Illustrations abound. A curved surface, as, say, a sphere, regarded as the envelope of (its tangent) planes, is a *two*-dimensional space of *planes*, while, conceived as the assemblage of (its tangent) lines, it is a *three*-dimensional space. The reader will observe that the term space is employed generically to denote any unbounded continuum of geometric entities. The generalization is, however, a natural one, for, for geometric purposes, ordinary space is viewed primarily as an assemblage of elements of one kind or another. To determine the position of a point in ordinary space, three independent data (as the distances of the point from three mutually perpendicular planes of references) are necessary and sufficient. Ordinary space is, therefore, *three*-dimensional in *points*, and that is what is meant, consciously or unconsciously, when, without specifying the element (point), it is simply said that space is three-dimensional. But tri-dimensionality is in no strict sense a *definitive* property of ordinary space. For some little understood, probably economical, certainly extra-logical, reason, the point recommended itself to primitive man as the element par excellence with which to geometrize, and so it has become traditional and proverbial that our space is essentially, uniquely, characteristically, intrinsically, exclusively three-dimensional. Such, however, it is not. It is indeed *three*-fold in *planes* as in points, but in *lines* it is *four*-dimensional. So, too, it is *four*-fold in *spheres*, but in *circles* its dimensionality is *six*. In general, it is possible by proper choice of element to endow any given space with any prescribed dimensionality however high. Accordingly, if by hyperspace is meant a space of dimensionality greater than 3, the notion is simple and near at hand, we need not go beyond ordinary space to realize it, we detect it in the line, in the plane, in ordinary space, here, there and yonder. Well, such *is* one of the recognized significations of the term. But it has "another," namely, hyperspace usually means a space whose *point* dimensionality is four or more. Now this latter meaning is *logically* and *conceptionally* quite consistent with the other; it is indeed a special case of it; but a hyperspace of *points* is difficult or impossible to *picture*, to realize in *visual imagination*, and it is this non-logical circumstance that renders the term hyperspace at once so tantalizing, mysterious, baffling and fascinating to the non-mathematician. To the mathematician, however, whose activities, so far from being confined within the limits of the visual imagination, lie for the most part quite beyond them, the conception in question offers as such no difficulty whatever, and it has long since established itself among the most approved of orthodox scientific notions.

Definition of Hyperspace of Points.— What, then, is a *hyperspace* of *points?* How is the notion arrived at? And what is its utility? The values of a single continuous variable x are familiarly representable by the points of a right line; the ordered *pairs* of values of two independent variables x_1 and x_2, by the points of a plane; and the ordered triplets of values of three independents x_1, x_2, x_3, by the points of ordinary space. To the analyst with geometric bias or predilection, the suggestion immediately and forcibly presents itself and there *ought* to be a space whose points would serve to represent, as in the preceding cases, all ordered sets of values of n independent variables $x_1, x_2, \ldots x_n$. Such a space is not present to *intuition, vision*, or *visual imagination*. The mathematician is not in the least concerned, however, whether his two or three dimensional geometry appeals to any visible space or not. His geometry is simply the theory of a certain structure which is exemplified by the system of pairs or triads of numbers, and after an imperfect fashion by the space of our experience. The transition to the theory of the systems exemplified by number tetrads, pentads or n-ads is simple and natural.

Co-ordinates, etc.— In point space of n dimensions the simplest co-ordinates of the point are the distances $x_1, x_2, \ldots x_n$ of the point from n mutually perpendicular point spaces of $n-1$ dimensions. These co-ordinate spaces, taken $n-1$ at a time, determine n co-ordinate axes. A linear equation $\xi_1x_1 + \xi_2x_2 + \ldots \xi_nx_n + 1 = 0$ defines or represents an $n-1$-dimensional space of order *one*, the analogue of the plane in ordinary space. The ξ's are the negative reciprocals of the axal intercepts of the $n-1$-space. Holding the x's fixed and letting the ξ's vary, the foregoing equation will represent a point as envelope of its generating $n-1$-spaces. Two such equations together define an $n-2$-space as their intersection or a straight line as their envelope. Similarly, three such equations serve to represent an $n-3$-space as locus of points or a plane as envelope of $n-1$-spaces, and so on. A space that is n-fold in points is also n-fold in spaces of $n-1$-dimensions. Its dimensionality is $2(n-1)$ alike in lines and in spaces of $n-2$ dimensions. In general, its dimensionality is $p\,(n-p+1)$ if the point space either of $p-1$ or of $n-p$ dimensions be taken as generating element. Not only, however, do the two last-mentioned elements furnish the same dimensionality, but they are indeed reciprocal elements of n-fold point space, for the same system of equations which on proper interpretation defines one of the elements admits of a second (dual) interpretation defining the other. It thus appears that by taking as elements the various simple spaces of less than n dimensions for generating elements of n-fold point space, there arise n geometries of this space; or, if we regard two reciprocal theories as but two aspects of one geometry, the elements in question yield $n:2$ or $1+(n-1):2$ geometries according as n is even or odd, the element having $(n-1):2$

dimensions being, in case of n odd, its own reciprocal, or *self-reciprocal,* like the line in ordinary space. See LINE GEOMETRY AND ALLIED THEORIES.

Remarks on Four-space.—Thus point space of four dimensions is also 4-dimensional in ordinary spaces (say *lineoids*), the point and the lineoid being reciprocal elements. It is 6-dimensional in *lines* and also in *planes,* which are also reciprocal elements of this space. It appears that this space, unlike ordinary space, does not admit of self-reciprocal construction. An equation of degree n in point (lineoid) co-ordinates x_1, x_2, x_3, x_4, (ξ_1, ξ_2, ξ_3, ξ_4) represents a locus (envelope) of *order* (*class*) n. If $n=1$, the locus (envelope) is a lineoid (point). Two linear equations define a plane as locus or a line as envelope; three, if independent, represent a line as locus or a plane as envelope; and four give a point or a lineoid. In general, two planes have, not a line, but only a point in common; reciprocally, two planes are not in general in a same lineoid. A lineoid being determined by four independent points, it appears that two arbitrary lines determine a lineoid. In 4-space a point can pass from the inside to the outside of a (2-dimensional) closed surface, such as an ordinary sphere, without going *through* the surface, just as in ordinary space a point can pass from the inside to the outside of a circle without *crossing* the circumference. Accordingly, in 4-space a 3-fold solid like the human body could be literally seen through, and no ordinary prison-house could confine.

Do hyperspaces exist? Undoubtedly they have *logical* existence, the *concept* of hyperspace being interiorly consistent and available for thought. More mathematics does not demand. The hypothesis of their «physical» existence, «natural» science may yet be compelled to employ. Indeed it has been conjectured that certain chemical phenomena (as of the carbon compounds) may be due to greater freedom of motion than ordinary space affords. However, except in so far as time and space are part of one 4-dimensional system, as is required by the theory of relativity (q.v.) the observations of physics do not find any clear evidence of a motion in the fourth dimension.

Bibliography.— The literature of the geometry (both pure and analytical) of hyperspaces is very extensive. It is, however, chiefly contained in the mathematical journals. All scientific nations have contributed to the subject, the Italians probably more than any other. The best work for the beginner is P. H. Schoute's 'Mehrdimensionale Geometrie' (1902). An excellent explanation, addressed to the non-mathematician, of the concept of 4-space is found in Hermann Schubert's 'Mathematical Essays and Recreations.'

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HYPERSTHENE, a mineral of the orthorhombic pyroxines, similar to enstatite and bronzite, but containing more iron. It is found in crystal forms occasionally, but most generally in granular masses as a large constituent of igneous rocks, such as norite, gabbro, hypersthene-andesite, etc. Excellent specimens are found also in connection with labradorite and other basic feldspars. The color is brownish-black, sometimes with a bronze-reddish tinge, which responds to polishing and is valued for ornamental purposes.

HYPERTROPHY, in pathology, the overgrowth of any part or organ resulting from equal increase of all the constituent parts of that part or organ. It may be caused, first, by an increased exercise of the part, an exemplification of which is seen in the blacksmith's arm; second, by an increased supply of blood to a part, the part being healthy. Hypertrophy, as a rule, is a desirable process, the part or organ in question increasing in size and therefore in function just as much as is necessary to supply unusual demands made upon it. Mere increase of size, as in the case of abscess or tumors, in an organ is not hypertrophy.

HYPNOTICS are agents that induce sleep. They may be mental, physical or medicinal. Thus certain kinds of music, the human voice and suggestion may have power to induce sleep, which may also follow from eating, or from a walk, or a warm bath before retiring. All such simple measures should be used before drugs are resorted to in the treatment of insomnia (q.v.). Hypnotics *per se* may be divided into two broad groups — those that induce sleep by alleviating pain and those that have no pain-relieving character. The latter are pure hypnotics. Combinations of the two are frequently employed in medicine. The pain-relieving drugs all come under the head of analgesics (q.v.). The pure hypnotics may be divided into a number of groups based on their chemical relationship, for in this class of drugs the relation between chemical composition and physiological action is peculiarly close. Alcohol is one of the most prominent of the hypnotics, but while it is extensively used to induce sleep, the practice of taking a «nightcap» cannot be regarded as a safe one. Substituted alcohols, however, yield some of the most widely employed of all hypnotics. Chloral, paraldehyde, amylene hydrate belong to this series, while from chloral as a basis a number of allied hypnotics have been made. These are chloralamide, chloralose, chloretone, urethane, etc., which are all regarded as less objectionable than alcohol. They all dilate blood-vessels, relieve spasm and induce sleep. In large doses they depress the heart action. Another group of hypnotics includes substituted sulphur compounds. The most important of these are sulphonal, trional and tetronal. They are all closely allied in chemical structure. Sulphonal is the weakest, tetronal the strongest, trional occupies a middle position. In poisonous doses, and even in small doses if long continued, hypnotics of this group cause a form of chronic poisoning in which the red blood-cells are disintegrated. This is shown by the appearance of a cherry-red or purple-red discoloration in the urine. A third group of hypnotics depends on some form of bromine, as bromides. Sodium bromide, potassium bromide, bromal bromoform, etc., are representatives. These are regarded as the least objectionable. They depress the activity of the brain and are useful hypnotics. If used very long the bromine compounds cause skin-eruptions, foul breath and heart-depression. See ALCOHOL; CHLORAL; INSANITY; INSOMNIA; NEURASTHENIA; SULPHONAL.

HYPNOTISM, hĭp'no-tĭsm, the process by which one person, called a hypnotist, obtains, holds and exercises control of the will, voluntary powers and sensory organism of another person, the subject (or victim). The character of hypnotism has been a matter of long dispute, and the literature of the subject is very contradictory, but the facts have finally been demonstrated, and come to the knowledge of a number of advanced physicians, who are endeavoring to promulgate them. Hypnotism has been known and practised through the ages, and is referred to in early writings as the "evil eye." There is no reason to doubt that the sorcerers and wizards of olden times were in many cases hypnotists, whose bewitching consisted in hypnotizing others and taking advantage of the supremacy thus gained over them. Dr. James Braid of England, originator of the word hypnotism, in 1841, gave public exhibitions of hypnotism, brought on by inviting the subjects to blank their minds and gaze on a bright object, and then by exercising his will to overcome their wills. Because he made no conscious use of animal magnetism, Braid thought he had discovered something different from mesmerism — the name given to hypnotic therapeutics as practised by Franz A. Mesmer at ~~Paris~~ late in the 18th century. But it is now apparent that mesmerism and hypnotism are identical, except in the method of inducing the state of artificial somnambulism. It has also been demonstrated that the mediumistic trance is accomplished on the same underlying principle — that of robbing the subject or victim of his will power by a partial or total paralysis of the brain. It is also now known that hypnotism is ~~not~~ the harmless pastime ~~nor~~ and the wonderful curative agent which it has long been ~~supposed to be~~. It is granted by all authorities on the subject that one person may surrender his will, and be put into an abnormal hypnotic sleep through exertion of the will of a hypnotist, and that in this condition the subject or victim can be made to do very many foolish and ridiculous things for the amusement of spectators, or he may be put into such a deep coma that a surgical operation can be performed without his knowledge or feeling any pain, the hypnosis serving the purpose of an anæsthetic. The discovery that hypnotism could be used to put patients to sleep for severe operations was hailed by the surgical profession with delight, as the anæsthetics generally used are not wholly satisfactory. It led to the practice of hypnotism by various medical men, and some of them undertake to use it to cure bad habits, such as the liquor habit, by so-called "suggestion" to the patient while he is under hypnotic influence.

That all practice or experiment with hypnotism is wrong and harmful is not at first apparent, and has been suspected only by a minority. Those stage exhibitors who found money in it, and those physicians who found it an interesting addition to their stock of methods of cure, have generally been loud in defending the practice when attacked, and unquestionably most of the physicians have been honest in such defense. The continued delusion on the subject has been due largely to the misuse of the simple word "suggestion" — there being so many suggestions which are harmless, and which are employed legitimately to effect cures by stimulating the faith of the patient. Faith is indeed a powerful curative agent, according to views held by many physicians.

But the so-called "suggestion" of hypnotism is a very different thing, because what the hypnotist really does is to paralyze the normal action of the brain of his victim, and rob him of his will power; and then to give him, while this helpless state continues, imperative commands which he is ~~powerless to resist~~, because he is for the time — in just so far as he is controlled — a slave to the will of his hypnotist. To call this "suggestion" is somewhat like applying the term suggestion to the act of the highwayman who orders one to hand out his money at the point of a revolver.

Foster's 'Medical Dictionary' defines hypnotism as "an abnormal state into which some persons may be thrown . . . by the exercise of another person's will, and consequent obedience to the suggestions."

The 'Standard Dictionary' defines mesmerism as "an abnormal condition resembling sleep, with or without somnambulism, during which the mind of the subject remains passively subject to the will of the operator."

Dr. John D. Quackenbos, in his work on 'Hypnotism in Mental and Moral Culture,' states: "It has long been known that a human being can be thrown into an artificial sleep, during which he sustains such a relation to an operator who has induced it that he is sensitive only to what the operator tells him he is sensitive to, and is wholly subject, so far as his mental operations and physical actions are concerned, to the volition of his hypnotist. A hypnotized person sees, hears, tastes, smells and feels what the operator says he sees, hears, tastes, smells and feels — ~~and nothing else~~. For the time being his individuality is surrendered to the person who has hypnotized him."

Dr. James R. Cocke says on page 35 of his work on 'Hypnotism': "The moralists . . . are right to condemn a practice which may rob a man of his free will without the possibility of resistance on his part."

Dr. Luys, of the Charity Hospital of Paris, in his 'Clinical Lectures,' says: "You cannot only oblige this defenseless being (hypnotized subject), who is incapable of opposing the slightest resistance, to give from hand to hand anything you choose, but you can also make him sign a promise, draw up a bill of exchange, or any kind of agreement. You can make him write an holographic will, which he will hand over to you, and of which he will never know the existence. He is ready to fulfil the minutest legal formalities, and will do so with a calm, serene and natural manner, which would deceive the most expert law officers. The somnambulist will not hesitate, either, you may be sure, to make a denunciation, or bear false witness. They are, I repeat, the passive instruments of your will."

No!

Prof. L. A. Harraden, in his book 'Hypnotic Exhibitions' (p. 10), relates how "Nancy thereupon made a man of straw and placed it, unknown to the patients, in a well-known professor's bed. A properly submissive subject was next chosen, put to sleep and furnished with a real dagger. He was then ordered to go and stab the sleeping professor through the heart. The sensitive promptly obeyed in an unmistakably thorough and decided manner.»

This same Prof. L. A. Harraden, in 'Hypnotism Made Easy,' p. 5, says: «The subject . . . responds as automatically as a locomotive obeys the manipulations of its driver. He is, indeed, for the time, a mere thinking automaton. He is given up to the domination of any idea that may be made to possess him. . . . His mind, having lost its power of self-direction, cannot shake off the yoke of any dominant idea, however tyrannical, but must execute its behests.» He says also on p. 4; «The subject is insensible to his surroundings and yet under perfect control of the operator, who may direct his thoughts into any channel desired and compel him to execute any command.»

Dr. J. D. Buck of Chicago writes in 'Life and Action' (Vol. II, p. 368) of a subject or victim of hypnotism: «In whatever degree he is dominated or controlled by the will, wish, idea or purpose of another, incarnate or excarnate, to precisely that degree, to the last scruple, is he a *Slave* in his own house, unrational and irresponsible.»

In Psychical Research 'Proceedings' (Vol. XI, p. 146) Charles L. Tuckey says of Dr. E. Mesnet of Paris: «He comes to the same conclusion as Bernheim and Leigeois, of Nancy, that these highly sensitive subjects can be subjected to ill treatment, made to sign documents and impelled to commit crimes by hypnotic suggestion.»

'The Great Work,' edited by F. Huntley, p. 158, states: «The hypnotic process . . . may be set in motion by any person who possesses the necessary intelligence and will-power, quite regardless of his moral status; . . . it may be invoked by a criminal of the most vicious and degenerate character.»

Moreover such subordination is progressive in its insidiously evil tendencies; for, as it has been truly said, the condition is more readily induced the second time than the first, the third time than the second, the subject ultimately becoming so pliant to the will of the operator that a fixed look or a wave of the hand may compel instant obedience.

Dr. I. Sossnitz of New York writes: «Hypnotism is certainly not a cure for any disease. On the contrary, it is harmful in its final effect. The eminent French physician, Charcot, discarded it after a thorough trial, and many other prominent physicians have given it up as harmful. The mysterious and fascinating methods involved in hypnotism, and, above all, the lack of understanding of the fundamental points of hypnotism, are responsible for the successful spreading of this misleading and dangerous 'art.'»

A «modern instance» should find place here, and such an instance is recorded in the files of Chicago newspapers of June 1906. On the 22d of that month Richard G. Ivens, of Chicago, a peaceful, temperate, well-behaved young man of 24, of rather weak will but good character, was hung, having been found guilty by a jury «of very moderate intelligence» of assault and murder of a young woman. His lawyer presented a good alibi, but the evidence against him was a confession twice obtained by the police under «third degree» methods, and repeated somewhat differently by him in court, but which he at «all other times» repudiated, saying he was innocent. J. Sanderson Christisen, a reporter assigned to the case, who knew something of hypnotism, was so convinced that Ivens was hypnotized on the occasions of the confession and corroboration and wholly innocent of the crime, that he republished the entire case in pamphlet form and sent copies to leading psychologists. On the statements of this pamphlet, Profs. William James and Hugo Münsterberg of Harvard, Dr. Max Meyer of the University of Missouri, Dr. Herbert A. Parkyn of the Chicago School of Psychology, Dr. Joseph Jastrow of the University of Wisconsin and others expressed their belief, some of them quite emphatically, that Ivens' confession was not true, and bore every evidence of being produced by hypnosis.

The foregoing citations are made to emphasize the ample scope of the evidence that hypnotism, when complete, robs the subject or victim of his will power, of his self-control and substitutes the control of another person. The honest physician hypnotist, who still believes in hypnotism as a therapeutic agent, has to face these facts: All authorities agree that hypnotism is an artificial, unnatural or abnormal sleep; they all agree that the victim is robbed of or loses his will power for the time; they all agree that his bodily functions respond to the will of his hypnotist. The victim is robbed of his will just as surely as if he were doped with whisky or morphine, but in addition the robber obtains control of his will. But nature gives an individual power through his will to control his own functions, obviously for the purpose that he and he alone may control them and be responsible; and so long as he exercises his will actively he sets up a barrier that no hypnotist can break down. This is why the hypnotist tells his subjects they must blank their minds and be passive.

These conclusions point to another interesting scientific fact which is making its impress on the scientific world. Mediumship has puzzled the leading scientists for over 50 years. They set out through the Psychical Research Society to prove mediumship and spiritualism a sham, and in the end Prof. Oliver Lodge, one of England's leading scientists, admits he is convinced of the reality of these things, and asserts that he has communicated with the spirits of the dead. Lombroso, Flammarion, Stead, Nordau and a host of others now admit Dr. J. M. Peebles' contention that it is possible to communicate with discarnate intelligences. If this be true, the process must be in harmony with universal laws of nature. That there is such a process, and that it is based on the control of the magnetic element of one person's being by another, as in hypnotism, is now confidently urged by many. See Spiritualism

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HYPOCHLOROUS ACID, an acid having the chemical formula $HClO$, which is formed when chlorine monoxide, Cl_2O, is dissolved in water. The most convenient method of preparing it is by distilling a mixture of dilute nitric acid and a salt of hypochlorous acid. The sodium salt of hypochlorous acid known as sodium hypochlorite, $NaClO$, may be prepared by passing a stream of chlorine gas through a cold dilute solution of caustic soda, $NaOH$; the reaction being $2NaOH + 2Cl = NaClO + NaCl + H_2O$. Potassium hypochlorite may be prepared in a similar manner. Crude calcium hypochlorite, $Ca\ (ClO)_2$, known in the trade as «bleaching powder,» is prepared by acting upon slaked lime with chlorine gas. Hypochlorous acid and the hypochlorites possess powerful bleaching properties, owing to the readiness with which they part with a portion of their chlorine or of their oxygen. (See Bleaching). Hypochlorous acid is only known in its aqueous solution, which is a colorless liquid, with a peculiar smell. It decomposes readily with the liberation of chlorine, and the formation of chloric acid, $HClO_3$, the decomposition proceeding rapidly in the sunlight. Hydrochloric and sulphuric acids also decompose it with liberation of chlorine, the reaction in the case of hydrochloric acid being $HClO + HCl = H_2O + 2Cl$. Heat decomposes the hypochlorites, with formation of the corresponding chlorates and chlorides.

HYPOCHŒRIS, hī-pō-kē'rĭs, a genus of plants of the family *Compositæ.* The leaves resemble those of the dandelion, with more hairy surface, and the flowers are arranged and formed like the dandelion, but are smaller. It is generally relished by cattle. The most common species is *Hypochæris radicata,* found abundantly in fields in Great Britain and Europe, and in the eastern United States. The common name is long-rooted cat's ear.

HYPOCHONDRIASIS, hī″pō- or hĭp″-ō-kŏn-drī'ạ-sĭs, a morbid condition of the mind in which an individual fears himself afflicted with various diseases. The name comes from the ancient belief that the symptoms of this disorder came from perversions of the vital force in the liver and pylorus of the stomach. The tendency to this condition is frequently inherited; it is more common in males, and is sometimes brought on by excesses. Patients afflicted with hypochondriasis are apt to watch for any expression of abnormality in their bodies, to connect various symptoms, and to reach the conclusion that they are sufferers from some disease. In conditions of perfect health any individual may have slight, temporary twinges of pain, or may show passing changes in the functions of the organs; but by the hypochondriac these abnormalities are seriously regarded, and efforts to disabuse him are usually futile. Such constant fear and worry divert the nervous energy from its proper course, and may cause actual disturbance of the bodily functions that are serious. The condition known as neurasthenia may follow; also, more rarely, true melancholia. The milder cases continue in actual good health, but become an unhappy burden to themselves and others. In the treatment it is to be remembered that mental occupation outside of the thoughts of self is essential to a cure.

HYPOCOTYL, hī'pō-cŏt-ĭl, the axis which supports the cotyledons of seed plants. The growth of this part of the plant raises the embryo and holds it in place. Darwin considered it the most sensitive and active organ of the seed plant in its earliest stages.

HYPOCYCLOID, in geometry, a kind of roulette, the path traced in the plane of a fixed circle by a point in the circumference of another circle which rolls inside of the *fixed* circle. It is the opposite of the epicycloid, or the curve traced by a point in the circumference of one circle which rolls on the outside of a *fixed* circle. In this connection two other roulettes or trochoids may be mentioned: (a) The epitrochoid, the curve traced by a point *on* the radius (or radius prolonged) of a rolling circle, but not *on* the rolling circle, but only on the *outside* of the *fixed* circle. (b) The hypotrochoid, a curve generated in every respect like the epitrochoid, but with the exception that the generating or rolling circle runs only along the *inside* of the *fixed* circle. See Cycloid; Trochoid.

HYPODERMIC INJECTION (Greek *hypo,* under; *derma,* skin), a method of introducing medicines through the skin into the subcutaneous cellular tissue, sometimes deep into the fibres of a muscle by an instrument specially made for the purpose. This instrument is the hypodermic syringe, which is made of glass, with a graduated scale engraved on it, and fitted with a long, hollow, needle-shaped point of steel. It must be filled before using, to prevent the possibility of introducing air into the veins. Hypodermic injection should never be resorted to excepting under the specific directions of a physician and patients are distinctly cautioned against using «the needle» on themselves. A little carelessness in sterilizing may result in forcing germs into the system, resulting in abscesses or blood-poisoning.

HYPODERMIC MEDICATION, as opposed to endermic medication, means the administration of medicine by piercing the skin with a hypodermic needle so as to throw the drug directly into the circulation, and bring it immediately in contact with the seat of pain, if pain is to be treated. There are some drugs which act on the system in a manner which differs in accordance with the method of their administration; thus podophyllin is a powerful cholagogue when administered through the mouth; when administered hypodermically it promotes the secretion of the kidneys. There are, however, distinct advantages of a general character in this method of administering drugs. The action of the drug is more rapid, sometimes instantaneous; the effect is concentrated and intensified; it takes a smaller dose to produce the desired effect; it is sometimes easier and pleasanter than administration by the mouth, and often obviates unpleasant or even dangerous complications. The process of hypodermic injection was invented and brought into vogue by Dr. Alexander Wood of Edinburgh.

HYPODERMIS, in plants, a layer of cells underlying the epidermis. Tissues juxtaposed to the hypodermis and cells originating directly under the epidermis are called hypodermal.

HYPODERMOCLYSIS, hī′pō-dėr′mŏc-lĭ′sĭz, the subcutaneous infusion of saline solution, which is steadily replacing blood transfusion in operations. See TRANSFUSION.

HYPOGENE, a term applied to the internal forces of the earth that produce deformation of the crest. See GEOLOGY.

HYPOPHOSPHITES, salts of hypophosphorus acid (q.v.).

HYPOPHOSPHOROUS ACID, an oxyacid of phosphorus, having the formula H_3PO_2. The free acid is of no importance in the arts, but its salts, which are called «hypophosphites,» are used in medicine. The acid is monobasic, only one of its hydrogen atoms being replaceable by a metallic atom. Sodium hypophosphite, $NaH_2PO_2 + H_2O$, may be prepared by acting upon caustic soda with phosphorus, phosphoretted hydrogen being given off, while sodium hypophosphite remains in solution. It crystallizes in small, rectangular tablets, which are easily soluble in water and in absolute alcohol. The evaporation of solutions of this substance is often attended by explosions. Barium hypophosphite, $Ba(H_2PO_2)_2 + H_2O$, may be prepared by heating baryta, BaO, with phosphorus and water until the elimination of phosphoretted hydrogen has ceased, the excess of BaO being then removed by a current of carbon dioxide, after which the solution is filtered and crystallized. Barium hypophosphite crystallizes in monoclinic needles, which are soluble in water, but insoluble in alcohol. Calcium hypophosphite may be prepared in the same manner as the barium salt. It has the formula $Ca\ (H_2PO_2)_2$, and crystallizes in thin, monoclinic tablets, which are soluble in six parts of water, but insoluble in strong alcohol. Free hypophosphorous acid may be prepared by decomposing the barium salt with sulphuric acid, and evaporating the solution at a temperature not exceeding 230° F. It crystallizes in large white tablets, which melt at 63° F., and are decomposed by heat, with the formation of phosphoretted hydrogen and ordinary tribasic phosphoric acid.

HYPOPHYSIS. See PITUITARY BODY.

HYPOSCOPE (from Greek words meaning «to see under»), is the name given to an instrument adapted to be secured to the stock of a rifle near the breech, and intended to enable a marksman to fire with accurate aim without exposing his head to the fire of the enemy. The successful American contestants for the Palma trophy at Bisley, England, in 1903, brought back with them this device, which seems likely to play an important part in the warfare of the future. It was invented by William Youlton of Brighton, England, who conceived the idea of it after the battle of Colenso in the Boer War, during which it is stated that not a single Boer was to be seen. Later in the war it was employed with good results, its use at Mafeking receiving particular mention.

The hyposcope consists of a series of mirrors mounted in a tube of inverted L shape; the shorter arm lies across the barrel of the rifle, while the longer arm hangs down at one side. The first mirror reflects the light coming in along the barrel of the rifle to a second mirror at the elbow of the instrument, which directs the rays downward to a mirror at the lower end of the tube, and thence it passes out at right angles to the eye. Thus on looking in at the eyepiece one can see the sights of his rifle, and take accurate aim while holding the gun above his head. The vertical arm of the instrument comprises two telescoping sections so that, by means of a thumbscrew at the side, this arm may be extended to elevate the device for long-range shooting. The amount of elevation may be accurately determined by means of a fine scale on the upper section. In order to allow for windage, a thumbscrew at the end of the horizontal arm may be rotated to move the mirror contained therein slightly to one side or the other. A scale on this arm shows just how far the mirror must be moved for different velocities and directions of the wind. The entire instrument is very compact and light, weighing about a pound. It is provided with a holster in which it may be encased to prevent it from sustaining any injury when not in use.

The advantages of this instrument in actual warfare will be apparent to all. Only the muzzles of the rifles are exposed to the enemy, and the soldiers are entirely concealed in the trenches. But aside from its advantages as a means of protection, the device will be found greatly to increase the effectiveness of the firing. The fear of being shot while taking aim makes the soldier fire hurriedly and at random; with the hyposcope attached to his rifle no fears will be entertained, and the soldier may fire deliberately and with perfect aim. By applying it to the end of a field-glass, an observer can watch the movements of the enemy without danger of discovery. It has also been designed for use on Maxim guns. Hyposcopes and similar instruments were much used by snipers during the great World War.

HYPOSTATIC UNION, the union of the divine and human nature in the one person of Jesus Christ. See TRINITY and related references.

HYPOTENUSE, in geometry, the longest side of a right angle triangle, opposite the right angle. According to Euclid, the square on the hypotenuse equals the sum of the squares of the other two sides, a theorem whose proof is generally attributed to Pythagoras. Recent research has discovered similar proofs in Egyptian and Chinese philosophies, considerably predating the Greek philosopher.

HYPOTHEC, HYPOTHECATION, a property lien arising from the operation of law or from a special agreement or contract. In Roman law it empowered the creditor to seize and dispose of the debtor's property. If more was realized from the sale than the amount of the debt such amount was returned to the erstwhile debtor. The debt might arise similar to a mortgage or a lien. See LIEN; MORTGAGE; REAL PROPERTY.

HYPOTHESIS, in logic, the antecedent of a conditional proposition. An extensive mathematical or scientific investigation often assumes the form of a vast conditional proposition. In such a case the hypothesis is usually stated once for all at the beginning and taken for granted in the rest of the investigation.

Mathematics is neither more nor less than the study of hypotheses of this type and the deduction of their logical consequences. Thus the axioms of Euclidean geometry form the hypothesis on the basis of which the propositions of geometry are proved. In natural science the truth of the hypothesis, which is a matter of indifference to the mathematician, is of fundamental importance. As this is but rarely, if ever, subject to a direct inspection, and cannot always be deduced from known generalizations, a hypothesis is generally established or destroyed by reference to its logical consequences. While a single unfulfilled consequence of a hypothesis is sufficient to refute it, no number of verified consequences, however large, is adequate to its complete demonstration. However, hypotheses have certain properties, by virtue of which their degrees of difference or similarity may be compared. It is, moreover, a principle generally valid that the fewer and less important are the details in which a hypothesis breaks down, the slighter will be the difference beween it and the true hypothesis. Thus a scientific hypothesis, which at first furnishes only a very crude approximation to the observed facts, by the gradual remodeling of detail after detail, comes as close to the truth of the matter as may be desired. The Darwinian hypothesis of natural selection is a good example of this; slow variations have been found an insufficient basis for evolutionary changes, and have been replaced by mutations; the theory of the inheritance of acquired characteristics has been discarded; and the whole notion of the survival of the fittest has been accommodated to these changes in opinion. The modern theory of evolution is thus more firmly established than its predecessor, though it still remains a hypothesis capable of further rectification. See INDUCTION.

HYPOTHETICAL QUESTION. See EVIDENCE.

HYPOXANTHINE. See SARCINE.

HYPSOMETRY (Greek, «height-measurement»), the art of determining differences of elevation on the earth's surface. Three distinct modes of procedure may be adopted for measuring a given difference in level. The first and most accurate of these consists in running a «line of levels» between the two stations whose difference in height is to be determined. This operation is conducted as follows: Let A, B and C be any three points on the earth's surface, such that the difference in level between any two of them is not more than a few feet; and let us suppose that B lies between A and C, and that it is not more than a few hundred feet distant from either of them. A precise spirit level is set up at B, so that its telescope is higher than either A or C. A graduated staff is then held in a vertical position upon the point A, and the observer at the level determines, by looking through the telescope, which division of the staff is of precisely the same height as the cross-hairs of his instrument. If the height of A is known, we have merely to add to it the known length of the graduated staff, from the ground up to the division that has been observed, in order to ascertain the exact height of the cross-hairs of the level. The staff is next carried forward to the point C and a second observation of the same kind is made upon it at this point. The height above the ground of the division that is here found to be on a level with the instrument is then subtracted from the known height of the cross-hairs in the telescope and the result is the height of the point C. The instrument is then carried forward to a point, D, situated beyond C, and the altitude of a still more remote point, E, is determined in the same manner, by observing the graduated staff at C and at E, and then calculating the height of E from the known height of C, as determined by the preceding operation. A chain of observations of this sort is called a «line of levels,» and it is obvious that the difference of elevation of any two points whatever may be determined with great precision by running such a line from one of them to the other.

The labor and expense of joining two distant points by a line of precise levels are often prohibitively great; and hence when a high order of accuracy is not essential, trigonometric or barometric methods are used instead. In determining the height of a mountain (for example) by the trigonometric method, a conveniently situated station is selected, from which the summit of the mountain can be well seen and the horizontal distance from this station to the vertical line passing through the summit of the mountain is first determined by any of the methods used by surveyors for determining the distance of an inaccessible object. The apparent angular elevation of the mountain is next observed; that is, the angle included between the horizontal plane through the station and the line joining the station to the top of the mountain is measured. If the earth were flat and devoid of any atmosphere, these data would enable us to compute the height of the mountain with considerable precision. For the vertical height of the mountain above the station and its horizontal distance from the station, and the line joining the station to its summit, would constitute the three sides of a right-angled triangle; and the base of this triangle being known, as well as one of the adjacent angles, its vertical height (that is, the height of the mountain above the observing station), could be easily calculated by the ordinary rules of trigonometry. In the actual case, however, the problem is complicated by the curvature of the earth's surface and by the refraction effects due to the presence of the atmosphere. Corrections can be easily applied for the curvature, since that is constant in any given spot, and its value is well known. The refraction effects, however, are variable from time to time, according to atmospheric conditions; and it is impossible to determine them, at any given moment, with a precision sufficient to enable the trigonometric method to compete, in accuracy, with the method of leveling already described.

The third general method of determining elevations on the earth's surface depends upon the fact that the atmosphere possesses weight, so that its pressure diminishes as we pass upward. The difference in depth of two given points below the surface of the sea can be determined with a good deal of precision by noting the hydrostatic pressures at the two points. If these pressures are expressed in pounds per square foot and their difference is divided by the weight, in pounds, of a cubic foot of the water, the quotient will be the difference in depth of the two points, expressed in feet. The same general principle applies to the determination of the differences of elevation in the atmosphere, only in this case the problem is far less simple in its actual application, because the air, instead of having a practically constant density as water has, is very elastic and compressible and very sensitive to changes of temperature. The observations, therefore, have to be combined by means of a formula which will take these facts into account, so far as possible. In determining differences of height by this method (which is called «barometric hypsometry»), the difference in atmospheric pressure at the two points that are to be compared is usually determined by means of barometric readings, though the boiling-point method, to which reference will presently be made, is also used. The mercurial barometer gives the most accurate results, but the aneroid form is so much more convenient to manipulate and transport that it is commonly preferred for ordinary work. (See BAROMETER). When the difference of elevation between two given stations is to be determined, it is preferable to make the barometric observations at both places simultaneously, simultaneous observations of the atmospheric temperature being also taken. This implies the co-operation of two observers and the possession of two sets of instruments; and hence it is not always feasible. When the work is carried out by a single observer, or with a single set of instruments, the observations should be made first at Station A, then at Station B and finally at Station A again; the average readings at Station A, both of barometric pressure and of temperature, being adopted as the definite observations at that station. In this way the effects of variations of temperature and pressure are eliminated as far as possible. If h is the average reading of the barometer at the lower station, in inches, and H is the reading of the barometer at the upper station, also in inches, and if t and t' are the temperatures observed at the two stations, on the Fahrenheit scale, then the difference in height between the two stations, as expressed in feet, is approximately

$$(\log h - \log H) \times 60{,}158.6 \times \left(1+\frac{t+t'-64}{900}\right)$$

In place of the barometer, an instrument called a «hypsometer» is sometimes used for determining the difference in barometric pressure between the two stations. The hypsometer is essentially an instrument for determining the boiling point of water with a considerable degree of precision. Water, which at the normal atmospheric pressure boils at 212° F., boils at a lower temperature on the tops of mountains, where the atmospheric pressure is less. The change in the boiling point is approximately 1° F. for every 511 feet of ascent; though this relation is not exact. In the practical application of the method, the boiling point is observed, on the mountain top, by an accurate thermometer which should be graduated as fine as fiftieths of a degree on the Fahrenheit scale. The difference between the temperature so obtained and 212° F. is then multiplied by the constant factor 511 and added to n $(n-1)$, where n is the difference in temperature, and the result is the desired estimate of the height of the mountain above the sea. This procedure, it will be seen, assumes that at the time the observation is made, the atmospheric pressure at the sea-level has its normal (or average) value, so that water would boil there at 212° F. precisely. This condition will seldom be more than approximately fulfilled, and hence the method by boiling points, as usually carried out, is more uncertain than the barometric method as described above. The thermometric method is very convenient, however, and for this reason it is in strong favor among travelers and explorers, who usually are content with a more or less rough approximation to the height to be measured. The method is capable of being refined further than has here been indicated; but when more accurate results are desired than are obtainable by the process as described above, it is better to make use of simultaneous readings of the barometer and thermometer, at the two stations to be compared. (See SURVEYING). Consult Johnson, 'Theory and Practice of Surveying' (17th ed., rewritten by L. S. Smith, New York 1913).

HYRACODONTS, small, long-legged, slender, swiftly-running prototypes of the rhinoceros of the early Tertiary. They had short heavy heads and no horn on the nose, so that they depended entirely on their speed for safety and had much the look and manners of the primitive horses. The group (*Hyracodontidæ*) was a large one, but the typical hyracodonts were confined to the Eocene and Oligocene periods of North America.

HYRACOTHERIUM. See HORSE, EVOLUTION OF THE.

HYRAX, hī'rąks, the type-genus of a group of small rabbit-like animals forming the group *Hyracoidea*. There are two species, not very sharply defined, the daman (*H. Syriacus*), which spreads from the African shores of the Red Sea to Syria, and the Klipdas, or dassy (*H. Capensis*), which ranges from Abyssinia to the Cape of Good Hope. The former is the animal meant by the Scripture reference to «conies,» as a «feeble folk». They are gregarious, plant-feeding, and make their homes among loose rocks, where they are little seen during the day. Hence English settlers called them rock-rabbits. The zoological position of these animals is astonishing in view of their size, appearance and rodent-like habits, for they are most nearly related to the elephant and rhinoceros. In west-central Africa live two or three small arboreal species (*Dendrohyrax*). O. Thomas (Proceedings of Zoological Society of London) says that the rules of priority require that the family and genus should be called *Procaviidæ* and *Procavia*. They are believed to be little modified descendants of the *Condylarthra*.

HYRCANIA, Asia, an ancient district, south of the Caspian Sea, bounded on the east by the Oxus River, and on the southeast by the Elburz (formerly Sariphi) Mountains, which marked the boundary between the district and Parthia; and on the west by Media. Hyrcania covered the territory now occupied by Mazanderan and Astarabad. Its chief city was called Tape by Strabo, and was probably situated on the site of the present city of Astarabad.

HYRCANUS (hėr-kā'nŭs) **I**, JOHN HYRCANUS, a Jewish high-priest and prince of the Asmonean family, who ruled in 135–105 B.C. He was the son and successor of Simon Maccabæus. At first dependent on the Syrians, he succeeded in throwing off their yoke, and also in subjugating the Samaritans. He next overcame the Idumæans, and obliged them to submit to Judaism. He afterward confirmed his powers by an alliance with the Romans and made Judæa more powerful than it had been since Solomon's time. He was originally a Pharisee, but ultimately favored the Sadducees.

HYRCANUS II, high-priest of the Jews and prince of the Asmonean family, who ruled intermittently from 69 B.C. to 30 B.C. He was the grandson of Hyrcanus I. His younger brother, Aristobulus, seized the government, and finally Pompey removed Hyrcanus from the kingship, and made Antipater of Idumæa governor of the colony. In 47 B.C. Cæsar proclaimed Hyrcanus tetrarch and high-priest. Antigonus, son of Aristobulus, deposed Hyrcanus and removed him to Seleucia, whence later, at the request of Herod, he returned to Jerusalem, where he was finally put to death (30 B.C.).

HYSLOP, hĭs'lŏp, **James Hervey**, American psychologist and educator: b. Xenia, Ohio, 18 Aug. 1854. He was graduated from Wooster University (Ohio), studied also at Leipzig and the Johns Hopkins universities, taught successively in Lake Forest University, Smith College and Bucknell University, and was appointed professor of logic and ethics in Columbia University. He became well known for his connection with the investigations of the Society for Psychical Research, of which he is the secretary, and as editor contributed extensively to its proceedings and *Journal*. His further work includes articles in prominent periodicals; an edition of Hume's 'Ethics' (1893) with introduction; a textbook on 'The Elements of Logic' (1892); one on 'The Elements of Ethics' (1895); 'Democracy: A Study of Government' (1899); 'Logic and Argument' (1899); 'A Syllabus of Psychology' (1899); 'Problems of Philosophy' (1905); 'Science and a Future Life' (1905); 'Enigmas of Psychic Research' (1906); 'Psychic Research and the Resurrection' (1908); 'Psychic Research and Survival' (1913).

HYSSOP, hĭs'ŭp (*Hyssopus*), a genus of plants of the family *Menthaceæ*, with four straight diverging stamens and a 15-ribbed calyx. The common hyssop (*H. officinalis*) is a perennial shrubby plant about two feet in height. The leaves stand in pairs without petioles. The flowers are blue, growing chiefly on one side of short verticillate spikes. It is a native of the south of Europe and the East, and is sparsely naturalized in the United States. The leaves have an agreeable aromatic odor, and an extract from them is produced by water and spirits. The hyssop of Scripture (that is, the plant whose Hebrew name *esob* has been translated "hyssop") has not been ascertained. As it "grew out of the wall," it must have been a diminutive plant, and may have been one of the mosses. The most probable and most widely accepted view is that it was the caper-plant (*Capparis spinosa*), but it is not unlikely that the name was applied to several plants of somewhat similar properties. The name of hedge-hyssop is applied to species of plants of the genus *Gratiola*, belonging to the family *Scrophulariaceæ*.

HYSTASPES, hĭs-tăs'pēz, the name of several persons in Persian history: (1) The father of Darius I, who, while ruler of Persia, made his son governor of Parthia. He has sometimes been identified with Vishtaspa, the patron of Zoroaster in the Avesta, but later historical research has established the impossibility of this theory. (2) The son of Darius I, and brother of Xerxes. He is mentioned as having led a contingent of Bactrians and Sacæ in the army of Xerxes. Consult Jackson, 'Zoroaster, the Prophet of Ancient Iran' (New York 1898); and Justi, 'Iranisches Namenbuch' (Marburg 1895).

HYSTERESIS. See MAGNETISM.

HYSTERIA, a morbid state of the nervous system in which the clinical manifestations present a wonderful variety of symptoms closely simulating some forms of organic disease. There is often increased physical irritability; the condition is frequently manifested by neuralgic pains, hyperæsthesias, hallucinations and convulsive and paralytic phenomena. It may be regarded as a brain affection — a mild insanity.

Among the causes of hysteria heredity plays a most important part. There may be direct transmission of the hysterical temperament from parent to child or other nervous manifestations in the family and its branches, such as epilepsy, chorea, neuralgia, insanity, etc. It occurs more frequently in women, but it is much more common in men than is ordinarily believed; it occurs in boys and girls at a tender age or about the time of puberty. Briquet found that one-eighth of his cases were in children under 10 years of age. Anything which lowers the general tone of the nervous system may give rise to it in predisposed persons. Hæmorrhages, severe illness, poor food, anæmia, overwork in uncongenial occupations, anxiety, fright, jealousy, disappointments, make a profound impression; so does an education which fosters and stimulates inherited instability. The enforced social restrictions of women, which they often inflict upon their young children, with lack of proper exercise for physical development and an artificial and premature education and habits heighten this predisposition. Accidents are a frequent cause of the first appearance of hysteria, as has been clearly pointed out by Charcot. The disease may, at times, occur in young girls who have witnessed attacks in others.

To understand the symptoms of hysteria, it must be borne in mind that there are two classes of phenomena. These have been termed the *mental stigmata* and the *mental accidents*. The stigmata are anæsthesias (loss of sensation), amnesias (forgetfulness), abulias (loss of will power), motor disturbances and modifications of character. These are the cardinal symptom-groups that characterize the mental state of the hysteric. Any or all of the mental accidents may likewise be noted — suggestibility and sub-conscious acting, fixed ideas, ecstasy, automatism, convulsive movements, sleep-walking, deliriums, etc. The occurrence of these constitutes important corroborative evidences of hysteria and while not found in all hysterics, they may be very common symptoms.

Hysterical persons often complain of some of the symptoms found in neurasthenia — neuralgic pains in various parts and hyperæsthetic areas about the abdomen, chest or back, frequently in the neighborhood of the ovary, mammary gland, etc. There may be anæsthetic patches in various parts of the body or there may be complete loss of sensation on one side associated with anæsthesia of the mucous membranes. The special senses on that side are involved — sight, taste and hearing.

There may be irritations of the bladder and urethra; pain in the joints, which may be mistaken for joint disease.

In some cases the senses are exceedingly acute. Persons notice odors imperceptible to others; are often made sick by odors which do not affect normal individuals; may have a liking for odors and substances disagreeable to others. Perverted sense is shown in an abnormal taste, in eating soap, slate-pencils, etc. Hysterical manifestations in some are simply emotional exaggerations; they laugh and cry without cause. In serious attacks there are likely to be various hysterical manifestations. Occasionally tactile sensibility is disturbed and the muscular sense may be abolished. The anæsthesia may affect the mucous membranes of mouth, pharynx and nose, abolishing the reflexes of the parts. The secretions may be diminished or arrested.

Spasmodic convulsions and paralytic phenomena may occur. The spasmodic attack may be rhythmic; may simulate the trembling of organic disease; may be confined to one member or involve the entire half of the body; may be coarse, as in disseminated sclerosis, or a fine tremor, as in paralysis agitans, or the tremor may simulate the trembling of organic brain disease. It may occur in any muscle or group of muscles; may manifest itself as contracture, which may be intermittent or may last continuously for months or years. Contracture may be confined to the strong muscle of the jaw and other muscles in their neighborhood, causing trismus. Spasms of the glottis may take place giving rise to severe difficulty in breathing; or of the pharynx, causing difficulty in swallowing. Globus hystericus is a constant symptom, but is not as frequent as it is often thought to be. Persistent and severe vomiting often occurs, but the nutrition rarely suffers materially from these attacks. Retention of urine is frequent, owing to spasm of the sphincter, and the catheter may have to be used for months.

Paralysis occurs in these cases; it is variable in distribution and may come on suddenly after a convulsive attack or without it; it may be flaccid or associated with contracture; it may come on slowly; it may be confined to one limb or be hemiplegic in type.

Hysterics are easily affected by pleasurable or painful impressions, and there is often a morbid craving for sympathy and attention. They may show moral perversion; may lie, steal, quarrel with and intrigue against their own family; may form and change attachments and dislikes without obvious reason; may manifest aversions, as to frogs, spiders, mice, cats, etc.; may deceive for deception's sake or to excite wonder. Some are painfully depressed; they have forebodings or are compelled to do certain acts. Here the hysterical insanities are approached on the one hand and the imperative conceptions and neurasthenias on the other.

Hystero-epileptic attacks in their greatest severity are often preceded by general discomfort or by hallucinations of vision and hearing. Usually sudden, they may be preceded by an «aura,» globus hystericus, singing in the ear, etc. Breathing is spasmodic; consciousness is obscured; the convulsion may be similar to those of mild epilepsy. In some cases the body is thrown into all sorts of contortions. An extreme opisthotonos may be present, the body being bent backward, resting on the head and heels. Gestures and noises are made. Sometimes religious ideas have an influence over the attitudes assumed; at other times, ideas of demoniacal possession.

From milder forms, recovery is the rule. In graver cases, and when there is a strong neuropathic tendency, the persons will probably pass from one hysterical manifestation to another.

Treatment.— In cases where there is deterioration of the physical health, tonics and nutritious diet should be given. Hydrotherapy improves nutrition and also the mental state. Many drugs have been recommended, but they are all uncertain in their action, at one time giving a result and failing at another. Convulsive attacks may at times be stopped by the cold douche to the spine. Isolation from the family circle is of the utmost importance in the treatment of these cases. Every effort should be made to discover the psychic shock which has produced the attack. Only the patient may have knowledge of this and he will not often reveal it. There is no disease the treatment of which it is more difficult to describe. Suggestion-therapy gives by far the best results, but the great difficulty is that good results are rarely permanent.

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SMITH ELY JELLIFFE.

HYSTEROPHYTES, hĭs'tē-rō-fīts. See FUNGI.

HYTHE, hīth, England, a market town and municipal and parliamentary borough of Kent, about 70 miles southeast of London, served by the South-Eastern and Chatham Railway. It is situated not far from the sea, Romney Marsh intervening, and is a popular resort. Hythe is connected with Sandgate, three miles distant by a sea-wall and parade, and an electric tramway along the shore front. On a height near the town is the interesting church of Saint Leonard, of late Norman style. In its vaults there are several human skulls and bones, supposed to be the remains of Norsemen or Danes killed in battle near the town in 456. The cemetery near the church contains the remains of Lionel Lukin (b. 1742; d. 1834), the inventor of the life-boat. The guildhall of Hythe was founded in 1794. Saint Bartholomew's Hospital was founded in 1336 by Haimo, Bishop of Rochester, while Saint John's Hospital is still older, the date of its foundation as a lepers' home being unknown. It was remodeled and reconstructed in 1802. In 1854 the government established a musketry school at Hythe, which has far outgrown its original proportions. Not far away from Hythe is Lympe, now three miles inland, which is thought to have been the original harbor, which as one of the Cinque Ports, enjoyed special privileges. The course of the estuary is easily traceable for all the distance between Hythe and Lympe. The latter place has the ruins of a Roman fortress and modern excavations have uncovered many other Roman remains. Great parts of the walls of the Roman fortress still stand, together with a well-preserved circular watch-tower. Some of the material of the Roman *Portus Lemanis* were used in the early English church of Lympe, the tower of which was built by Lanfranc. Saltwood Castle nearby is of great historic interest, being very old even in the time of Richard II. In 1026 it was given to the See of Canterbury; was escheated to the Crown after the murder of Thomas à Beckett, and again given to Canterbury by King John. The archbishops resided there until the reign of Henry VIII. In 1882 it was restored as a residence. Hythe, variously spelled Heya, Hethe, Hithe, i.e., landing-place, was already of importance as a seaport in Saxon times. Halfden granted it to Christ Chursh, Canterbury. In the Domesday Survey the borough is given as part of the archbishop's domain, and the bailiff of the town was his appointee. It was one of the Cinque Ports even before the Conquest; its liberties and privileges were confirmed by King John in 1205 as they were under Edward the Confessor. These privileges were again confirmed in Magna Çarta, and subsequently by general charters from various kings down to James II. In return for these privileges — freedom from toll, etc.,—Hythe with its sisters of the Cinque Ports furnished 57 vessels for the service of the sovereign, and of these five were furnished by Hythe. In 1365 it sent four members to Parliament, this being the first time it had any representation there. The government of the port until 1574 was vested in twelve jurats; but in that year Queen Elizabeth incorporated it under the title of «mayor, jurats, and commonalty of Hythe.» On 29 June privilege was granted to hold a fair for the sale of fish. The filling up of the harbor with sand gradually choked off the sea-borne commerce of the town and it declined considerably in importance. The waterworks are the property of the municipality. Pop. 6,500.

HYVERNAT, hī'vĕr'nạt, **Eugène Xavier Louis Henri**, French-American Oriental scholar: b. S. Julien-en-Tarrêt, Loire, 30 June 1858. He was educated at Saint John's Seminary and the University of France, Lyons, the Seminaire de S. Sulpice and Seminaire d'Issy, Paris. In 1882 he was ordained to the priesthood and the following three years was chaplain of the church of Saint Louis of the French, at Rome. From 1885 to 1889 he was employed as interpreter of Oriental languages at the Propaganda, Rome, and also in 1885–88 as professor of Assyriology and Egyptology at the Roman Seminary. He also spent a year in Armenia on a scientific mission for the French government. Since 1889 he has been chief of the department of Semitic and Egyptian literatures at the Catholic University of America, Washington, D. C., where he is also professor of Oriental languages and archæology. He is a member of the Pontifical Roman Academy dei Nuovi Lincei, the Roman Academy of Archæology, the American Oriental Society and many other learned and scientific societies of both America and Europe. He has published 'Les actes des martyrs d'Egypte' (1886); 'Album de paléographie copte' (1888); with Paul Muller-Simonis, 'Du Caucase au Golfe Persique' (1892). He compiled 'Acta Martyrum,' with Coptic text and Latin translation, with G. Balestri (Paris 1907–08). He edited 'Scriptores Coptici'; 'Corpus scriptorum christianorum orientalium' and collaborated in Vigouroux's 'Dictionnaire de la Bible' and 'The Jewish Encyclopedia,' of which he was consulting editor.

I

I the ninth letter and third vowel of all the alphabets of western Europe, came into the Latin alphabet from the Greek. It is named in Greek iota, which is the yod of the Hebrew and the corresponding letter of the Phœnician alphabet from which the Greeks derived it. Iota and yod (whence jot) being the smallest letter in the Hebrew and Greek, gave occasion for the New Testament phrase «one jot or one tittle.» In ancient Latin the *i* appears to have stood for a semi-vowel like *y* as well as for the vowel *i*: thus the Latins would write Ianus, Iulia, pronouncing them *Yanus, Yulia.* And till a comparatively recent date words beginning with *I* and *J* were in English dictionaries classed together.

The dot over the *i* appears first in MSS. of the 13th century. The sound value of *i* in all languages except English is constant and is equal to *e* in he and to *i* in him. What is called the long sound of English *i* as in *hide* is a diphthong made up of the two vowels *a* and *i*: this value of *i* in English is believed to have been given to the letter not earlier than the 16th century; till then the letter had the same sound in English as in other languages.

In the standard alphabet of philologists the values of the vowels are about as in the languages of continental Europe, in which *i* is sounded as English *e.*

It is the general rule in English pronunciation that *i* followed by two consonants in the same syllable is short; yet when the two consonants are *ld* or *nd* the *i* is nearly always long and diphthongal, for example, *mild, rind;* in *wind* (noun) it is short, but in *wind* (verb) it is long. Combined with *o* it forms a true diphthong *oi* as in *oil;* it also forms diphthongs with *e* and *a,* as *rein, aisle,* or mere digraphs representing sounds in which often the *i* has no part; examples: *seize, pier, friend.* Usually a final *e* indicates that the *i* in a word is to be pronounced as the diphthong; for example, *fine* as contrasted with *fin;* yet *genuine* is *genuin;* or the *i* is pronounced as *e* long,— *marine, quinine, Augustine.*

In Pope's time and long after *oblige* was pronounced *obleege* and rhymed with *besiege*: the *i* in *oblique* is pronounced either *e* or *i.*

i.e. stands for *id est,* the Latin for «that is.»

I. H. S., an abbreviation for Jesus (Greek ΙΗΣΟΥΣ) — the H representing the long *e.* To mark the contraction, the abbreviation was formerly written I $\overline{\text{H}}$ C (Greek C=S), which in later times became I $\overline{\text{H}}$ S. The H being mistaken for the Latin H, the idea arose that I H S meant *Jesus Hominum Salvator,* «Jesus Saviour of Men,» and the mark of contraction over the H being thus rendered unmeaning, was turned into a cross, as on modern chasubles and altar-cloths. By some the letters were taken to mean *In Hoc Signo,* «In this sign» (i.e., the cross), and by others *In hac* (*Cruce*) *Salvo* «In this (Cross) Salvation.»

I. N. R. I., the abbreviation of the Latin inscription placed on the cross over the head of Jesus at the order of the Roman governor, Pontius Pilate. The full inscription reads: *Iesus Nasaræus Rex Iudæorum* (Jesus of Nazareth, King of the Jews), John xix, 19.

I PROMESSI SPOSI. See BETROTHED, THE.

I. W. W., see INDUSTRIAL WORKERS OF THE WORLD.

IAGO, a character in Shakespeare's ‹Othello.› He is the attendant of the hero, and is depicted as a jealous, hypocritical villain. His ambition is to avenge the slights, chiefly imaginary, which he has endured at the hands of his master. While ingratiating himself to Othello, he connives a plot against the chastity of Desdemona, Othello's wife. So successful is his clever villainy, that Othello's jealousy is properly aroused, and he kills his wife. Further events uncover the plots of Iago and he suffers the same fate. See OTHELLO.

IALYSUS, an ancient city of Rhodes. It was located near the northern end of the island on the western coast, and was probably settled by Phœnician traders. The Dorians colonized the place subsequently, and with Lindus and Camirus it formed the Tripolis of Rhodes. Ialysus was famed for its wealth. In the 5th century the towns of the Tripolis united to found the city of Rhodes. Significant remains of Mycenæan civilization have been unearthed at a necropolis discovered at Ialysus.

IAMBIC, in classical prosody, a term applied to verses consisting of feet made up of a short syllable followed by a long. In English, the same designation is used to denote verse in which the feet are composed of an unstressed syllable followed by a stressed, such as:

Ănd ín | thy̆ ríght | hănd bríng | wĭth thée
Thĕ móun | tăin nýmph | swĕet líb | ĕr tý

The iambic form is most easily adaptable to the English language.

IAMBLICHUS, i-am'bli-kus, Greek philosopher of the Neo-platonic school: b. Chalcis, Cœle-Syria; d. about 330 A.D. Little is known of the events of his life beyond the place of his birth and that he came of a noble family and was trained in philosophy under Anatolius and Porphyry. He wrote numerous works, but few have come down to us. His extant works are ‹On the Pythagorean Life›; ‹The Exhortation to Philosophy›; ‹On the General Science of

Mathematics'; 'On the Arithmetic of Nicomachus'; fragments of a work on fate, and on prayer; and 'Theological Principles of Arithmetic.' (See NEO-PLATONISM). Consult Whittaker, T., 'The Neo-Platonists' (Cambridge 1901), and Zeller, Eduard, 'History of Greek Philosophy' (New York 1889).

IAN MACLAREN. See WATSON, JOHN.

IAPETUS, a Titan, son of Uranus and Gæa. Hesiod claims that he was the father of the giants Atlas, Prometheus, Menœtius and Epimetheus. He participated in the rebellion against the gods and was condemned to live in Tartarus. Consult Myer, M., 'Giganten und Titanem' (Berlin 1887).

IBA, ē'bä, Philippines, pueblo and capital of the province of Zambales, Luzon, situated on a river two miles from its mouth, 85 miles northwest of Manila. Ih has a good anchorage and is on the south coast road. It is a well-built town, and has several fine public buildings. In 1901 a United States meteorological station was established there. Pop. 4,500.

IBACH, Lawrence J., American astronomer: b. Allentown, Pa., 17 Jan. 1816; d. Newmanstown, Pa., 9 Oct. 1888. He learned the blacksmith's trade and followed it throughout his life, chiefly at Sheridan, Lebanon County, Pa. He studied with the astronomer Charles F. Engleman, who, on his death in 1860, bequeathed all his charts, books and instruments to Ibach. His benefactor having promised to make several series of astronomical calculations for almanacs Ibach filled the first order (1863), and thereafter till his death made annual calculations for almanacs in the United States, Canada, South America and Cuba. He was commonly known as the "blacksmith-astronomer."

IBADEN, ē-bä'dan, Africa, a city of Yorubaland, southern Nigeria, about 125 miles northeast of Lagos, with which it is connected by rail. The town is built of low thatched houses, relieved by a few more modern structures. There are several mosques, and idol houses. Agriculture and handicraft work are the chief occupations of the town. Ibadan is the capital of one of the Yoruba provinces. The government is in the hands of a civil and a military ruler; in addition to which there is a woman who has charge of the disputes of the women. The British maintain a resident and a detachment of Hausa troops there. Pop. about 150,000.

IBAGUE, ē'ba-gä', Colombia, a city and capital of Tolima, about 60 miles west of Bogotá. Its situation at an elevation of some 4,000 feet renders its climate particularly salubrious. In addition to its commercial activities, Ibagué is occupied in mining the extensive sulphur and silver mines of the vicinity. The founding of Ibagué dates back to 1550. Pop. about 25,000.

IBAJAY, ē-bä-hī', the Philippines, pueblo of the province of Capiz, island of Panay, situated on the Ibajay River, 42 miles northwest of Capiz, the capital of the province. Pop. 15,000.

IBAÑEZ, ē-bä'nyäth, **Vicente Blasco,** Spanish novelist: b. Valencia, 1867. A member of the gild of modern Spanish writers of fiction, which includes Fernàn Caballero, Valera, Pereda, Palacio Valdès, Pardo Bazán, Pérez Galdós, to mention some of the best who have won recognition at home and abroad as masters of their craft. Vicente Blasco Ibáñez differs from most of them (much less, however, from Galdós than from the others) in that he, a revolutionist, has written largely for purposes of própaganda. Hence, his most effective stories are those in which, as in 'La Barraca,' 'La Bodega' and 'La Catedral,' he inveighs against features of the Spanish social system. He is undoubtedly a Socialist, voicing that protest against the existing order of things which is not uncommonly raised in his native district of eastern Spain. While in certain cases unable to acquiesce in his attacks upon society and its individual categories, it must be admitted that his pictures of phases of Spanish life are often a correct reflection of the facts and make manifest a need of reform. 'The Four Horsemen of the Apocalypse' (1918), added considerably to his reputation. See LA BARRACA.

IBARRA, ē-bär'rạ, Ecuador, city and capital of the department of Imbabura, 60 miles northeast of Quito. The chief industries are the manufacture of cotton and woolen goods. An earthquake almost demolished the town completely in 1868, since when it has greatly deteriorated. Pop. about 9,000.

IBERIA, ī-bē'rĭa. (1) The ancient name of a district of Asia, between the Euxine and Caspian seas. It now forms part of Russian Georgia, and consists of an extensive fertile plain, surrounded by mountains traversed by four passes. It probably belonged to Persia, until subjected by Pompey and Trajan to the Roman Empire, under which it remained till after the time of Julian. (2) The ancient name of Spain, the Ebro, the principal river, being called Iberus. The Iberian language still lives in the Basque. See BASQUES; CELTIBERI.

IBERIAN LANGUAGE. See GEORGIANS.

IBERIANS, an ancient people who dwelt by the river Iberus, the modern Ebro of Spain. About the time of Strabo the name was extended to the inhabitants of the entire peninsula. Of the distribution of this race and of its social and other characteristics we have only fragmentary and often contradictory accounts. Anthropologists now employ the term to the men of the Bronze and Neolithic Ages, whose skulls and remains are found in southwest Europe. Consult Keane, 'Man: Past and Present' (Cambridge 1899), and Sergi, 'The Mediterranean Race' (London 1901).

IBERIS, ī-bē'rĭz. See CANDYTUFT.

IBERVILLE, Pierre le Moyne, pē-âr lė mwän ē-bĕr-vēl, SIEUR D', French-Canadian naval and military commander: b. Montreal, 16 July 1661; d. Havana, Cuba, 9 July 1706. He entered the French navy, in 1686 took part in the successful expedition for the capture of the English forts on Hudson Bay; in 1689 he captured Forts Severn and Albany. In 1694 he was again on Hudson Bay and captured Fort Nelson; in 1696 he seized and demolished Fort Pemaquid, built for the protection of the New

England settlements, and laid waste the British settlements in Newfoundland, and in 1697, gaining a remarkable victory over a superior British fleet, recaptured Fort Nelson, the last post of the Hudson's Bay Company. In 1698 he sailed from Brest in charge of an expedition to discover the mouth of the Mississipi and plant a colony there, in both of which purposes he was successful. In 1699 he ascended the Mississippi for some distance, and built Fort Biloxi at the head of Biloxi Bay. This post he removed to Mobile in 1701. In 1706 he captured the island of Nevis. He was considered the ablest officer in the French naval service of his time, and is generally called the founder of Louisiana.

IBERVILLE, Canada, town and county-seat of Iberville County, Quebec. It is situated on the Richelieu River, about 38 miles southeast of Montreal, and is served by the Canadian Pacific, the Quebec, Montreal and Southern, the Central Vermont and Rutland railways. The principal industries are the manufacture of iron, pottery, agricultural implements, monuments and carriages. Pop. 2,000.

IBEX, any of several species of wild goat (q.v.), sometimes placed apart in a sub-genus *Ibex,* distinguished by the form of the horns of the ram, which are large (30 to 50 inches long), backward curving, compressed and marked on the front with bold cross-ridges or knob-like protuberances. The ibexes are larger than other goats, about three feet at the withers, although adults of the Himalayas stand 40 inches high. Their coats are harsh, uniformly brown, becoming much grayer in winter, whitish on the under surface and buttocks, and with darker tints on the face and fore-legs. These animals inhabit the most precipitous and inaccessible heights of lofty mountains, where they assemble in flocks, sometimes consisting of 10 or 15 individuals. During the night they feed in the highest woods, but at sunrise they again ascend the mountains, till they have reached the most perilous heights. They are remarkably swift, and display amazing agility and dexterity in leaping. Several species are distinguished by locality and minor differences. The typical ibex, bouquetin or steinbock (*capra ibex*), once numerous throughout the European Alps, now exists only as a semi-domesticated animal in certain valleys on the Italian border.

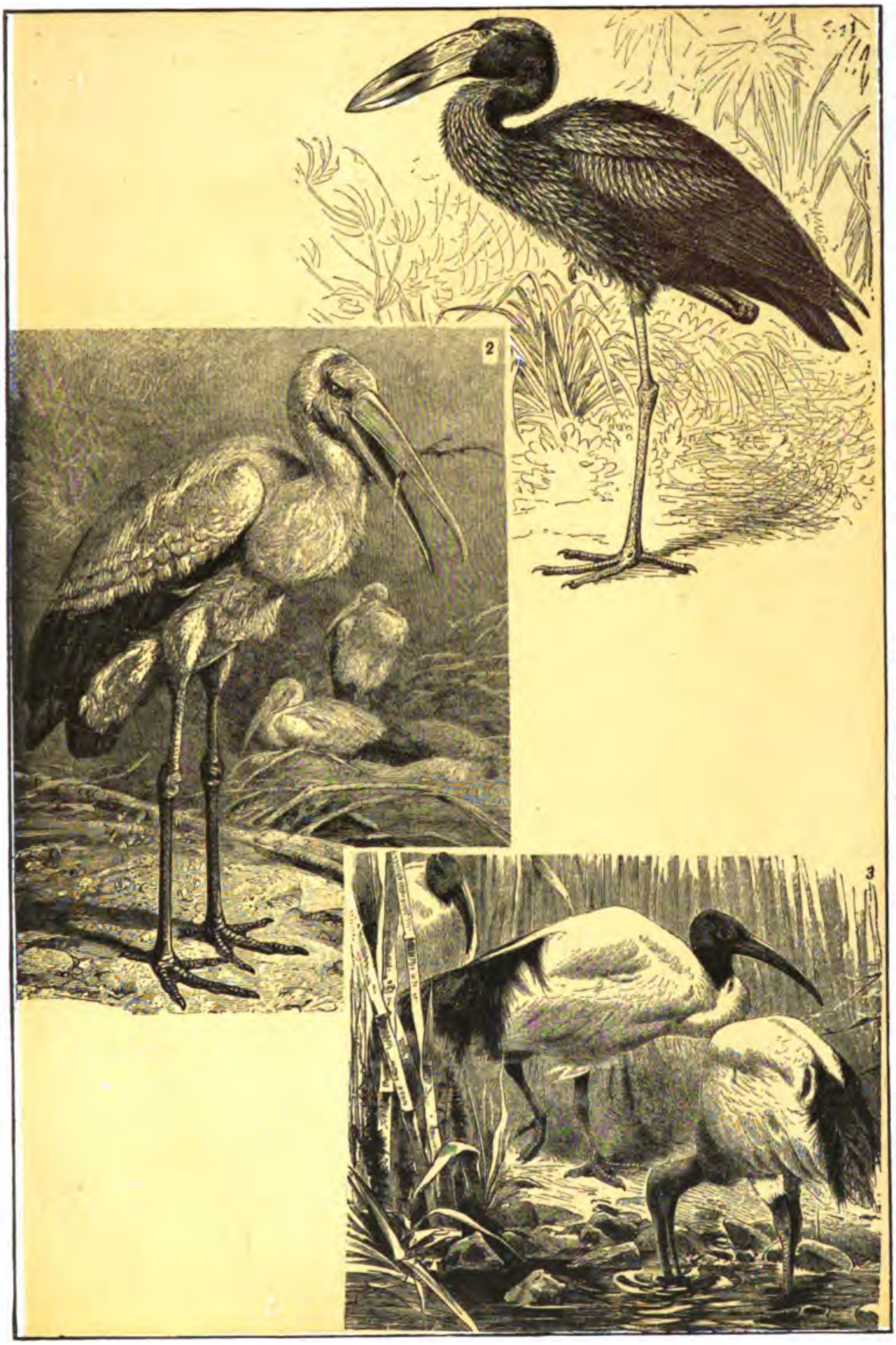
Other species are named according to their locality: The Arabian ibex (*C. sinaitica*) of Palestine, Arabia and northern Egypt (see BEDEN); the Caucasian ibex or tur (*C. caucasia*), having reddish hair and flattened horns; the Nilgiri ibex (*C. hylocrius*) of southern India; the Nubian ibex (*C. nubiana*), characterized by slender horns; the Abyssinian ibex or walie (*C. walie*), characterized by a protuberance of the forehead; and the great Himalayan ibex (*C. sibirica*), which ranges over the high mountains and plateaus of all central Asia, keeping as near the snow-line as possible, and affording the best sport known to that region of game. They move about in small herds, led by a dominating ram, the size of the herd depending mainly on his prowess in keeping together his family. Every spring the young rams leave or are driven away from the herd. When gestating the ewes seek retired spots where the hunter cannot readily locate them.

IBICUHY, ē-bē-kwē', or **IBICUI**, **Brazil**, an affluent of the Uruguay River, which rises in the Serra de Santa Anna, province of Rio Grande do Sul, and after a westward course of about 400 miles joins the Uruguay at Yapeyu opposite Saint Martin in Argentina.

IBILAO, ē-bē-lä'ō, a head-hunting Philippine tribe inhabiting the border lands of the provinces of Nueva Ecija and Nueva Vizcaya in the central part of the island of Luzon. They are heathens, of the Malay race, with an infusion of Negrito blood. See PHILIPPINE ISLANDS.

IBIS, a family of wading-birds (*Ibididæ*) inhabiting warm regions. They are related to the storks on the one hand and to the spoonbills and flamingoes on the other. Their bills are long, weak, curved and the nasal grooves are very long. The legs are long, the tibia partly naked and the toes long with small webs. In size they are like herons, rather less than storks; and in color present a great and beautiful variety of tints, often with a metallic sheen; the sexes are similar. Ibises are shy birds, which inhabit not only watery and wooded country, but dry plains and rocky gorges. They are capable of a powerful and elevated flight, extending their neck and legs and uttering a hoarse croak. They ordinarily wade for their food, poking in the mud with the long bill for aquatic insects, worms and small shellfish; they also catch fish, and on land eat insects, especially locusts, frogs, newts and crustaceans. Some species breed in communities, like herons, others apart, but the nest is always a rude cradle of sticks on a tree or ledge of rocks and occasionally on marshy ground, and the eggs are usually green, with or without markings. There are 12 or 15 genera and a large number of species scattered throughout the whole tropical zone. The typical genus, *Ibis,* contains the sacred ibis (*I. æthiopica*), called by the natives of Upper Egypt *abu Hannes,* or «Father John,» which arrives in Egypt about the time that the inundation of the Nile commences, its numbers increasing or diminishing with the increase or diminution of the waters; and it migrates southward about the end of June. This species is about the size of a fowl; the head and neck are bare; the body white; the wing tipped with shining, ashy black, among which the white forms oblique notches; the secondaries and scapulars, which in summer curve gracefully over the hinder parts, are bright black. This was one of the birds adored by the ancient Egyptians, and of which numerous mummies are found. The Greek and Roman writers give many fabulous stories relating to ibis, which Savigny has gathered in ‹Histoire Naturelle et Mythologique de l'Ibis.› He concludes that the reverence for this ibis was not due to its alleged destruction of snakes, which, in fact, does not occur, but arose from the birds' return at the time the Nile began to rise, the commencement of the season of abundance. Modern writers on Egyptian customs and antiquities may be consulted further on this point. Many other interesting species occur in Africa, Asia and the Australian region; and many species reside

THE IBIS FAMILY



REPRESENTATIVE IBISES

1 Open-bill (Anastomus lamelligerus) 2 Wood Ibis (Tantalus ibis) 3 Sacred Ibis (Ibis religiosa)

in the American tropics,— two, the white ibis (*Eudocimus albus*) and the scarlet ibis (*E. ruber*), flocking in summer in the southern United States. Both are birds of extreme beauty of plumage, and both have been so ruthlessly persecuted by plume-hunters, seeking feathers of millinery purposes, that the scarlet ibises are nearly exterminated. Fossil ibis remains of the Tertiary period have been located at many points in Europe.

Wood-ibises and shell-ibises are names for birds of other groups, elsewhere described. Consult Taylor, 'Ibis' (1878); Shelley, 'Birds of Egypt'; Whymper, 'Egyptian Birds' (1909).

IBN AL-KIFTI, ĭb'n ăl kēf'tē, Arabian historian and statesman: b. Kift, Upper Egypt, 1172; d. 1248. He greatly encouraged literature, education, art and national progress. See Kifti, Ibn Al-.

IBN BATUTA, bä-too'tą, **ABU ABDULLAH MOHAMMED,** Moslem traveler: b. Tangier, 1304; d. 1378. When he became 21 years of age he started on his journeys. His first trip was along the Mediterranean coast from Tangier to Alexandria. He visited Cairo, Aleppo and Damascus, and then journeyed to Mecca. After crossing to Isfahan and going back to Bagdad, he again made the pilgrimage to Mecca, remaining for three years. His next trip took him down the Red Sea to Aden; then along the African coast, and back by a circuitous route through Oman and Arabia to Mecca again. After a short stay, he again set forth, this time through Syria and Asia Minor, to Kaffa on the Black Sea. This was his first acquaintance with a Christian city. For a time thereafter he attached himself to the Khan Mohammed Uzbeg; and, with the court of a certain Greek princess who was of the same train, visited Constantinople. A trip through the lower part of Russia and his return to the Indus occupied the years until 1333. Not long afterward he was appointed kazi of Delhi by the ruler, Mohammed Tugklak. Here he remained for a number of years, retiring when his profligacy had destroyed his prestige. However, when the Chinese emperor had sent an emissary to Delhi and a man was needed to return with his contingent, Ibu Batuta was chosen. A wreck destroyed the party, and he was stranded at Calicut. He journeyed on to the Maldive Islands, becoming kazi there; visited Bengal, Burma and journeyed far into the interior of China. Eventually he stopped at Jerusalem and Cairo and returned in 1349 to Morocco, and thence to Tangiers. His last wanderings took him to Spain, central Africa and Egypt. His book narrating his many adventures was dictated by orders from the king. His descriptions are vivid and accurate, full of life and color. A French translation by Defrémery and Sanguinetti was published at Paris (4 vols., 1858–59).

IBN JANACH, ha-näch, **ABULWALID MERWIN,** or **JONAH MARINUS:** Jewish grammarian: b. Cordova, Spain, close of 10th century; d. early 11th century. After receiving training in Hebrew and in medicine, he became interested in philological research. His principal contribution to the study of Hebrew was his work on grammar 'Kitāb-al-Luma' which was a pioneer study of the whole field. His dictionary 'Kitāb-al-'Usūl' is replete with erudite and comprehensive discussion of the grammatical points involved. The former was published by J. Derenbourg (Paris 1886); the latter by Neubauer (Oxford 1873–75). In translation they have been published by B. Goldberg (Frankfort 1856) and by W. Bacher (Leipzig 1889). Consult Bacher, 'Leben und Werke des Abulwalid Merwan ibn Ganach' (Leipzig 1885).

IBN KHALDUN, ABD AL RAHMAN, Arabic historian: b. Tunis, 1332; d. 16 March 1406. He was a brilliant student of Arabic lore, and in 1352 entered the public service at Fez; being suspected of malfeasance he was imprisoned for a short time merely on suspicion. He emigrated to Spain and was well received at Granada. In 1364 he was driven back to Africa and was well received by the Sultan of Bougie. On the latter's fall Ibn Khaldun raised an army and entered the service of the Sultan at Tlemçen. In 1378 he was allowed to return to Tunis. Here he prosecuted his studies and produced his history of the Berbers. He set out for Mecca in 1382, but was prevailed upon to tarry in Egypt, where he was made cadi at Cairo. He instituted many reforms and began his history of the Arabs in Spain. In 1385 he made the pilgrimage to Mecca, and on his return was cadi no less than five times. In 1400 he visited Tamerlane at Damascus. His great work is the 'Universal History' in three books, with an introduction and an autobiography. Book one treats on the influence of civilization; book two of the Arabs and other peoples, and book three of the Berbers. An edition in Arabic appeared at Bulaq (7 vols., 1867). Part of the work has been translated by Slane in his 'Histoire des Berbèrs' (Algiers 1856). Book one was edited by Quatremère (3 vols., Paris 1858). The parts dealing with the Crusades were edited by C. Tornberg (Upsala 1840). Consult Flint, R., 'History of the Philosophy of History' (Edinburgh 1893); Huart, C. I., 'Histoire des Arabes' (Paris 1912); Nicholson, R. A., 'A History of Arabic Literature' (Cambridge 1907).

IBN KUTAIBA, koo-tä'ē-bą, **QUTAIBA** or **KOTAIBA,** Arabian author: b. Bagdad or Kufa, 828; d. Bagdad, about 889. He was a zealous student of history and philology, and was appointed local ruler at Dinawār. After a few years' service, he was made teacher at Bagdad, occupying this position until his death. Ibn Kutaiba is important as the author of several works which throw light on the Arabian language and antiquities. Of these the most noteworthy are the 'Adab ul-Kātib,' a treatise on literary style (edited by Max Grünert, Leyden 1900); Kātib al-ma-Arin,' a popular outline of history (edited by F. Wüstenfeld, Göttingen 1850); and 'Ayun al Akhbār,' a general treatise on government, nobility, character, science, friendship, women and food. It was edited by Brockelmann (Weimar 1898). Consult Brockelmann, 'Geschichte der arabischen Literature' (Vol. I, pp. 120–122, Weimar 1898).

IBN SINA, ĭb'n sē'nä. See Avicenna.

IBRAHIM, ē-bra-hēm', Ottoman Sultan, third son of Ahmed I. He succeeded his brother Amurath IV in 1640. His reign was occupied mainly with a war against Crete. He was an oppressive tyrant, with little consideration for his people. The Janizaries finally broke out in rebellion and put him to death.

IBRAHIM PASHA, Egyptian general: b. Kavala, Thrace, 1789; d. 1848. His father was Mehemet Ali, the pasha of Egypt. At the age of 16, he was sent as a hostage to the Ottoman Empire, but returned to Egypt after the failure of the English army to gain a foothold in his father's territory. In 1816 he led the Egyptian army in Arabia and was successful in vanquishing the Wahhabis in western Arabia and in Nejd. He proved himself an able commander, and in the War of Greek Independence was appointed in charge of both the naval and land forces in the Morea. His long siege of Missolonghi was conducted with great vigor and resulted in victory in 1826. He was so ruthless in his punishment of the Greek troops that European forces felt called upon to punish him. At the naval battle of Navarino (1827), his fleet met those of the combined English, French and Russian squadrons, and was completely destroyed. Shortly afterward the French expeditionary forces landed in Morea, and in 1828 Ibrahim was compelled to leave the country. He returned to Egypt, but it was not long before his father became engaged in a quarrel with Syria and Ibrahim again took the field. With characteristic impetuosity he laid siege to Acre, captured it and put the Turkish forces to rout. By the Treaty of Kutayah in 1833, Syria was surrendered to Mehemet Ali, and Ibrahim was made governor of Cilica. There was a lull in hostilities until 1839, when Ibrahim was sent out once more against the Turkish armies, and inflicted a decisive defeat at Nezib. However, by the intervention of foreign powers, the Egyptian armies were defeated on the sea, and their leader was again obliged to return to Egypt. He outlived his father by a few months, and his son, Ismail Pasha, succeeded to the rule of Egypt.

Ibrahim Pasha was distinguished by his extreme energy and vigor, as well as by his intelligence and docility in learning European methods from the armies with which he came in contact. As a ruler, he showed superior judgment and diplomacy, winning over hostile factions with great shrewdness and tact. Consult 'Cambridge Modern History' (Cambridge 1903).

IBSEN, Henrik, Norwegian dramatist: b. Skien, Norway, 20 March 1828; d. Christiania, Norway, 23 May 1906. He became an apothecary's apprentice in the little town of Grimstad, being forced to earn a living owing to the impoverished condition of his family, but was determined not to ignore any possibility of obtaining an education by reading and study. His opposition to convention at first took the form, so common among young persons, of an avowed advocacy of the wicked and irregular, expressed in the thought that if he should be destined ever to perform a great deed, it would necessarily be a "deed of night," and in his occupation with the study of the subversive characters of history, including chiefly Catiline (q.v.), who became the hero of his first play ('Catilina,' 1850). At Christiania, Ibsen attended a preparatory school in order to prepare for the medical school of the university. He failed in the entrance examinations, however, and undertook the publication, together with two other young men (Aasmund O. Vinje and the bibliographer, Botten-Hansen), of an unsuccessful weekly, *Andhrimnir*. Ibsen's contributions to this paper were short satires and lyrics. He was also much interested in Old Scandinavian history and legend, and began to write a number of dramas on themes connected with these legends, not uninfluenced by the works of Oehlenschläger (q.v.) and H. Hertz, the first of which is 'Kæmpehöjen' ('The Warrior's Grave,' 1850), which had three performances at Christiania and was later printed serially in a Bergen newspaper (1854). In 1851 the violinist Ole Bull obtained for him the position of manager in the National Theatre at Bergen, which he held until 1857. Very important for Ibsen's artistic development was the trip which he undertook in 1852, under instructions from the Bergen theatre, to inspect the theatres of Dresden and Copenhagen, which were then managed by Devrient and L. Heiberg, respectively. His chief duty in connection with the theatre at Bergen was to produce an original play for performance each year on the anniversary of the theatre's foundation (2 January). The 1855 play was 'Fru Inger til Östraat' ('Lady Inger of Östraat,' dealing with the events preceding the Reformation in Norway). In 1856 came 'Olaf Liljekrans' (not printed until 1898, and then only in German, as a part of the nine-volume edition edited by Georg Brandes for S. Fischer, Berlin), and in 1857, 'Gildet paa Solhaug' ('The Banquet of Solhaug'), a drama from the life of the Norwegian people in the 14th century. From 1857 until the bankruptcy of the Norwegian Theatre at Christiania, in 1864, Ibsen held the post of manager at that institution. In this period he produced only three plays, 'Hærmændene paa Helgeland' (1868) (introduced to the English and American stage a few years ago by Ellen Terry: 'The Vikings at Helgoland'), a pregnant, intense, laconic tale of Icelandic family feuds, taken from the Saga of Sigurd, and written in a prose not unlike that of the Icelandic sagas; 'Kjærlighedens Komedie' ('The Comedy of Love,' 1862), a rimed satiric play dealing with social conditions; and 'Kongsemnerne' ('The Pretenders,' 1864), another study of Norwegian history, interesting chiefly in that it presents a picture of self-confidence and moral responsibility in their struggle with laxity and irresoluteness, as personified in the persons of King Hakon and Jarl Skuli. In 1864 Ibsen was so fortunate as to obtain a traveling scholarship, and from this time until 1891 he spent almost all his time in foreign countries, where most of his great plays were to be produced, residing chiefly at Rome, Dresden and Munich. The larger, freer, more cosmopolitan life of Europe gave Ibsen a larger outlook than the narrow parochial atmosphere of the small Norwegian city, but he now turned to Norwegian themes with a greater intensity and vigor than before, treating them now as universal in their appeal; no dramatist ever limited himself so completely to his own country in his choice of subject, and none ever treated all his subjects so absolutely from the purely human point of view. 'Brand' (1866) and 'Peer Gynt' (1867) are the first of his great plays. They are the last plays Ibsen wrote before discarding verse. 'Brand' exposes the danger and destructiveness of the idealist who would force others to live accordin to his ideals, while 'Peer Gynt' satirizes the idealist who constructs a world only for himself and shuts all others out of it.

In 1869 came 'De unges forbund' ('The League of Youth'), a modern social comedy exposing the knavery of conscienceless political agitators and inaugurating the long line of social dramas, dealing with vital and concrete problems of every-day life, to which Ibsen was to devote the rest of his active labors. Once only (in his next play, 'Emperor and Galilean,' an enormous tragedy in two parts, of five acts each) he was to work again in the field of history, producing an impressive study of the clash of free will and historic preordination, impersonated in the character of Julian the Apostate, in his vain effort to restore paganism at a time when the world was already ripe for Christianity. It is the remaining plays, produced after 'Kejser og Galilæer,' with which readers are chiefly acquainted, which make Ibsen immortal, and which have entirely remolded the dramatic literature of the world since their appearance. They are 'Samfundets Stötter' ('Pillars of Society,' 1877), 'Et Dukkehjem' ('A Doll's House,' 1879), 'Gjengangerne' ('Ghosts,' 1881); 'En Folkefiende' ('An Enemy of the People,' 1882); 'Vildanden' ('The Wild Duck,' 1884); 'Rosmersholm' (1886); 'Fruen fra Havet' ('The Lady from the Sea,' 1888); 'Hedda Gabler' (1890); 'Bygmester Solness' ('The Master Builder,' 1892); 'Lille Eyjolf' (1894); 'John Gabriel Borkman' (1896); 'Naar vi döde vaagner' ('When We Dead Awaken,' 1900). These 12 plays are a complete *comédie humaine*, a comprehensive indictment of the evils necessarily associated with a disordered society, beginning with 'Pillars of Society,' which is a sort of headline synopsis, in cruder form, of all the plays that follow, and running on through play after play, each taking up and pursuing with merciless clearness some problem outlined but not completely disposed of in its predecessor. Thus, 'A Doll's House' puts the problem of the devoted self-sacrificing wife whose husband values respectability and social position above her affection, and who deserts him that she may know what life really is; it caused Ibsen's provincial critics to ask: «Why did she not remain? Was not her first duty with her two children?» Ibsen accordingly answered this question in 'Ghosts,' the next play, in which, in three terrible acts, he presents the case of a wife who remained with her husband and child. The husband's respectability cloaked a boundless dissoluteness, and the disease contracted in one of his dissipations causes the son to go insane many years later. The disclosure by Ibsen of these evils of modern family life led one of his critics to accuse him of being an «enemy of society,» and Ibsen's next play, 'An Enemy of the People,' in which an honest physician calls attention to the infected condition of the waters, from the supposed healing qualities of which his fellow-townsmen earn their living, is his answer. The honest Dr. Stockmann is termed an «enemy of the people» and finally driven out of town. Unqualified truth-telling, even when it may be personally unprofitable, would appear to be the lesson of this play, but in the 'Wild Duck' his thesis seems to be, as Shaw, his most brilliant interpreter puts it, «that a truth-teller who cannot hold his tongue on occasion may do as much mischief as a whole university full of trained liars.» The student wishing a complete interpretation of Ibsen and of the connection between his social plays is referred to G. B. Shaw's, 'The Quintessence of Ibsenism,' from which the above quotation is taken (1st ed., 1891); there is also an interesting but rather crabbed essay on 'Hedda Gabler' by Henry James. The understanding of the later plays, beginning with 'Rosmersholm' (1886), is rendered somewhat difficult by the introduction of numerous symbolic elements. The tone becomes one of bitter resignation, of regret at having wasted opportunities for natural living and real enjoyment. The last 15 years of his life were spent at Christiania, the last seven years in increasing mental disturbance, which indicated that Ibsen's mind was slowly weakening. In 1900, after the last play, 'When We Dead Awaken,' was finished (Ibsen seems to have intended it to be his last, for he called it «A Dramatic Epilogue»), a bronze statue (by Sinding) was erected to him in Christiania. See DOLL'S HOUSE, A; GHOSTS; HEDDA GABLER; MASTER BUILDER, THE; PEER GYNT; WILD DUCK, THE.

The reception of Ibsen's plays in Norway and in foreign countries was at first uniformly hostile. The venomous nature of the attacks by professional literary critics is best evidenced by the quotations given in Shaw's book (see above) from contemporary London newspapers, and is paralleled only by the similar outbursts called forth from the musical critics by the first of the epoch-making innovations of Richard Wagner. The New York press greeted the first American performance of 'Ghosts' in 1902 with equal hostility. But Ibsen's popularity long before his death was already so great that the later plays appeared simultaneously in all the capitals of Europe, translations into the important languages having been prepared before the publication of the original.

Bibliography.— Consult Ibsen's 'Collected Works,' with introduction by W. Archer (1906–07); 'Prose Drama,' edited by W. Archer (1890–91); 'Correspondence,' translated by Marison (1905); 'Lyrical Poems,' selected and translated by R. A. Streatfield (1902). Critical works on Ibsen are Jæger, H., 'Henrik Ibsen' (in Danish, 1888; Eng. trans. by Clara Bell, 1890); Brandes, G., 'Det moderne Gjennembruds Mænd' (Copenhagen 1883, trans. by J. Muir as 'Critical Studies,' 1899); Gosse, E. W., 'Ibsen' (1907); Macfall, H., 'Ibsen: the Man, his Art and His Significance' (1907); Moses, M. J., 'Henrik Ibsen: the Man and His Plays' (1908); Vasenius, V., 'Henrik Ibsen's dramatiska diktning' (Helsingfors 1879); id., 'Ett skaldeporträtt' (1882); Passarge, 'Henrik Ibsen' (Leipzig 1883); Brahm, O., 'Henrik Ibsen, Ein Essay' (Berlin 1887); Jæger, H., 'Henrik Ibsen og hans værker' (Copenhagen 1892); Andreas-Salomé, 'Henrik Ibsen's Frauengestalten' (Berlin 1892); Reich, 'Henrik Ibsen's Dramen' (Dresden 1903); Woerner, 'Henrik Ibsen's Jugenddramen' (Munich 1895); von Hanstein, 'Ibsen als Idealist' (Leipzig 1897); Garde, 'Der Grundgedanke

in Ibsen's Dichtung’ (Leipzig 1898); Brandes, ‘Henrik Ibsen’ (Copenhagen 1898); Woerner, ‘Henrik Ibsen’ (2 vols., Munich 1899 ff.); Litzmann, ‘Ibsen's Dramen, 1877–1900’ (Hamburg 1901).

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IBSEN, Sigurd, Norwegian diplomat and author, the son of Henrik Ibsen (q.v.): b. Christiania, 23 Dec. 1859. He lived in foreign countries with his parents until he entered the diplomatic service of Sweden (then forming a united monarchy together with Norway) in 1885. After working for a time in the Foreign Office, he was attached successively to the embassies of Washington and Vienna, but gave up this career in 1889, in order to devote himself to problems of a social and administrative character. He delivered a course of lectures on sociology at the University of Christiania in 1896–97, and in 1899 became head, in the Department of the Interior, of the Section for Foreign Affairs, Commerce and Industry. He was connected in various ways with the administrative service of the united monarchies until their definitive separation in 1905, maintaining to the last his advocacy of a continuance of the policy of union. He has held several editorial positions connected with radical papers. His published works include ‘Unionen’ (1891); ‘Mænd og Magter’ (translated into English as ‘Human Quintessence’), and ‘Robert Frank’ (a tragedy, translated into English by Marcia Hargis Janson, New York 1914). The last is the story of a scholarly aristocrat whose reasoning throws him into the arms of the syndicalist movement, as the leader of which he inaugurates a revolution in which he loses his life.

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IBYCUS, ĭb'ĭ-kŭs, Greek lyric poet: b. Rhegium, Italy, flourished in the 6th century B.C. He spent his days wandering about, singing his lyrics and narrating poems. He was for some time a member of the court of Polycrates at Samos. While traveling near Corinth, a band of robbers fell upon him and murdered him. The story is told that when the crime was committed, Ibycus called to a flock of passing cranes to avenge his death. The murderers traveled on to Corinth, and while seated at the theatre there suddenly noticed the cranes circling above their heads. One of their number, terror-stricken, shouted «Behold the avengers of Ibycus,» and the crime was betrayed. Ibycus was the author of charming lyrics, mainly love-themes, describing the love-inspiring charms of beautiful boys and girls. The fragments were collected by F. W. Schneidewin (1833). Consult Bergk, ‘Poetæ lyrici Græci’ (Leipzig 1882).

ICA, ē-kä', Peru. (1) A littoral department bounded north by the departments of Huancavelica and Lima, east by Ayacucho, south by Arequipa and west by the Pacific Ocean. Area, 8,718 square miles; pop. estimated at 90,000. Topographically the department slopes from its eastern border to the ocean, with small ranges of hills. It has a hot and arid climate and the soil is little adapted to agriculture except in the valleys. Gold, copper and iron are mined. Grapes and sugar-cane are grown as well as corn, cotton and indigo. The only industries are those dependent on the viticulture and the sugar-cane crop. (2) A town, capital of the above department, on a river of the same name, 46 miles southeast of Pisco on Pisco Bay, with which it is connected by rail. It was founded in 1563. It is in a grapevine and sugar-cane producing region and has manufactures of wine and brandy. Pop. 9,000.

IÇÁ, ē'sä', or **PUTUMAYO,** a river of South America, one of the chief tributaries of the Amazon. It takes its rise in the Andes in Colombia, flows southeast and empties into the Andes near San Antonio. It is navigable during the wet season for about 900 miles of its course, which is nearly 1,000 miles in length. It waters a woody region, unfavorable to close habitation. There are rubber plantations along the shores. A large part of the Içá was explored in 1878–79.

ICARIANS, ī-kā'rĭ-ănz, a communistic society founded and led by Étienne Cabet. For an account of this organization see CABET.

ICARIUS, in Greek mythology the hero after whom the Attic deme Icaria is named. Dionysus taught him how to make wine, which he gave to some shepherds. Their companions thinking their intoxication was due to poisoning murdered Icarius. His daughter Erigone was led by the hound Mæra to his grave on Mount Hymettus under a tree on which she hanged herself. During a plague of madness which Dionysus sent over the land, the Athenian maidens, following Erigone's example, hanged themselves. The Acora or «swing» festival later commemorated the propitiation to Icarius and Erigone, who also, with the dog of Mæra, were placed among the stars as Arcturus, Virgo and Procyon.

ICARUS, the son of Dædalus (q.v.).

ICAZBALCETA, ē-kạs-bạl-sā'tạ, **Joaquin García,** Mexican author: b. Mexico City, 1825; d. 1894. He contributed numerous biographical articles to the ‘Diccionario universal de historia y geografía.’ His historical researches are most important and are a great storehouse of information. They include ‘Colección de documentos para la historia de México’ (1858–66); ‘Historia eclesiástica indiana, obra escrita á fines del siglo XVI por Francisco Gerónimo Mendieta de la órden de San Francisco’ (1870); and ‘Nueva colección de documentos para la historia de México’ (1886–92); ‘Bibliografia Méxicana del siglo XVI,’ an exhaustive study, and ‘Don Fray Juan de Zumarraga’ (1881), the life and work of the first bishop and archbishop of Mexico.

ICE, water in the solid state. When sufficiently cooled, water loses its fluidity, and becomes filled with multitudes of needle-like crystals belonging to the hexagonal system (see CRYSTAL), which increase and interlace until the whole mass becomes solidified. In nature, this change begins at the surface of the water and spreads gradually downward, so that the exact course of the freezing is not so easy to trace as it is in the laboratory, where the water can be uniformly cooled throughout its entire mass. When the freezing process is complete, the crystalline nature of the solid that results from it is not at all obvious. It is clearly visible, however, in snow-flakes, where the hexagonal form is also evident. In a solid block of ice the crystalline structure can also be demonstrated by a method that was used by Tyndall, as a beautiful and instructive lecture experiment. The image of a slab of pure ice is thrown upon a screen by means of a projection lantern provided with a powerful electric light. At first nothing is seen, but very shortly the heat-rays passing through the ice cause it to melt internally, and the melting takes place according to the internal crystalline structure, which is gradually brought out upon the screen in great beauty. Six-sided stars, suggestive of the snow-crystals, appear, and these enlarge and become serrated at the edges as the electric beam gradually destroys the molecular architecture, the process continuing until the ice has been again reduced to the liquid form.

Pure water normally freezes at a temperature which is denoted by 32° on the Fahrenheit scale, and by 0° on the Centigrade and Réaumur scales. It is possible, however, to cool pure water to a temperature considerably lower than this, if proper precautions are taken, without crystallization. As long ago as 1836, for example, Gay-Lussac observed that water, when placed in a vessel and covered with a layer of oil, may be cooled to 10° F. without freezing. If the vessel be slightly shaken or jarred, however, solidification ensues at once.

Pressure has an effect upon the temperature at which water freezes. This effect was predicted, from theoretical considerations, by James Thomson, in 1849. Dewar has since measured its amount with much care, finding that the freezing temperature is lowered by 0.014° F. for each atmosphere of pressure. Small as this quantity is, it is of importance in some branches of physics. In 1858 Mousson, by the application of an enormous pressure, succeeded in reducing the freezing point to 4° below zero, Fahrenheit. The presence of dissolved substances in the water also depresses the freezing point. Sea-water, for example, freezes at about 27° F. (the ice that is formed being nearly free from salt), strong brine is used in the circulating pipes and cooling coils of refrigerating plants, since it can be cooled much below this temperature without freezing.

The effect of pressure in lowering the freezing point is illustrated in the familiar process of making a snow-ball from damp snow — that is, from snow whose temperature is precisely 32° F. Under the pressure of the hand, the freezing point of the snow mass is lowered slightly, with the result that a partial melting of the crystals takes place. When the pressure is removed, the freezing point rises to the normal, and the water that was formed by the pressure alone freezes again, and cements the mass together. (The superficial moisture, due to the warmth of the hand, is not here contemplated. The melting from this cause is a separate phenomenon.) The slight but real plasticity of large masses of ice, such as are met with in glaciers, is probably related to this phenomenon of the variation of the freezing point by pressure, but there is some difference of opinion among the authorities as to the precise way in which the slow downward flow of these ice masses is accomplished. The melting of ice by pressure, and its subsequent solidification upon the removal of the pressure, is known to physicists as «regelation.»

Experiments that have been conducted in connection with precise thermometry, by Pernet and Marek, show that the temperature of melting ice is slightly different, according to the source of the ice, and the way in which it is treated; this variation being independent of the pressure, and probably due to unrecognized impurities. A variation in the melting point of as much as 0.164° F. has been observed; and in order to eliminate the effects of error from this cause, it is necessary, for the purposes of precise thermometry, to adopt a uniform mode of procedure in the treatment of the ice that is to be used for the establishment of the freezing point upon accurate thermometers. Consult Guillaume, 'Thermométrie de Précision' (Chap. 2).

When water that contains solid matter in solution or in suspension is frozen, the solid matter is mostly eliminated, so that the ice is much purer than the water from which it is produced. Some of the solids are almost invariably entangled among the interlacing crystals of the ice, however, so that numerous little particles of foreign matter often remain in the ice, imprisoned in tiny cavities. Bacteria and other germs that may have been present in the original water appear to be largely excluded from natural ice by the freezing process, though some of them are undoubtedly caught among the crystals and retained. In artificial ice, where a mass of water is frozen simultaneously on all sides, so that the solidification proceeds from the outside toward the centre of the cake in all directions, purification from this cause is hardly possible, and the middle part of the ice-cake is likely to be rich in whatever germs the original water may have contained. Fortunately the recent experiments of Sedgwick and others indicate that freezing and protracted storage of the ice is much more fatal to typhoid bacilli than was formerly supposed. Artificial ice, if prepared from distilled water, or from water that is certainly known to be free from disease germs, is undoubtedly safer than natural ice that is taken from streams or ponds of unknown purity; but in choosing between natural and artificial ice from the same identical water, the preference should be given to the natural product.

Water expands upon freezing, one volume of water at 32° F. becoming transformed, by freezing, into 1.0908 volumes of ice at the same temperature; which is equivalent to saying that water expands by one-eleventh of its own bulk upon freezing. The quantity of heat required to melt one pound of ice, from the state of ice at 32° F. to that of water at 32° F., is 142 times as great as the quantity of heat required to raise the temperature of a pound of water from 32° F. to 33° F. The specific heat of ice, near the temperature 32° F., is approximately 0.50. The production of ice by artificial means has increased rapidly in recent years. See REFRIGERATION AND REFRIGERATING MACHINERY.

ICE, Artificial. See ICE INDUSTRY; REFRIGERATION AND REFRIGERATING MACHINERY.

ICE AGE. See GLACIAL PERIOD.

ICE BOAT. See Ice Yachts and Ice Yachting.

ICE-BREAKER, a vessel, especially a strong heavy steamer, with powerful engines, for opening up navigable channels in frozen waters. On the Great Lakes of the United States, where such vessels are extensively used, they are generally fitted for carrying cargoes or transporting railroad cars. Such vessels are usually so built as to run their bows up on the ice and break it by means of their great weight.

ICE INDUSTRY. Though the use of natural and artificial ice as an article of commercial value practically began only in the first part of the 19th century, yet the artificial production of cold began long before the modern civilized era.

In Greece and Rome during the early ages snow was more commonly used, being placed in cone-shaped pits 45 feet in diameter, 50 feet deep and lined with straw and prunings of trees. The snow was packed down and covered with more straw and prunings, over all of which a thatched roof was placed; after the ice was formed it was cut and carried out through a door left in the side of the pit for the purpose. During the 16th century snow and ice were stored in cellars for the purpose of cooling drinks. This custom spread from Greece and Italy to western Europe and to France during the reign of Henry III in the 16th century, and by the end of the 17th century the sale of snow and ice had become a profitable trade. From that time until the beginning of the 19th century the ice trade was practically at a standstill, no material advance being made in the direction of improving the methods of harvesting the ice supplied by nature; nor was any attempt of any importance made to produce artificial ice. For the purposes of description and comparison, ice may be divided into two classes, the natural and the artificial.

Natural Ice.— Probably the first ice cut and shipped as an article of commercial value was sent, in 1799, from New York to Charleston, S. C. This cargo was cut from a pond near Canal street. While this shipment was the first recorded it was of little importance; the real beginning of the industry came in the year 1805 when Frederic Tudor of Boston, shipped a cargo of 130 tons to the West Indies. This resulted in a loss of $4,500, and Tudor's second shipment, two years later, to Havana likewise was made at a loss enormous for those days. He stuck to the business, however, and finally; in 1812, was granted by Great Britain a monopoly of the trade with her colonies in the West Indies, and later, in 1815–16, Spain granted him the same concession to export to Havana. In 1817–18 the trade was extended to Charleston and Savannah; to New Orleans in 1820; to Calcutta in 1833; and to Rio Janeiro in 1834. Thus a large and lucrative trade with southern countries and southern cities of the United States was built up; competitors began to come into the field, the first of these to enter the export field being the firm of Gage, Hittinger and Company of Boston, who introduced American ice to the people of London. They were in turn followed by a Salem merchant named Lander, and others.

The harvest of natural ice is gathered on an enormous scale in the United States, the demand for the article being due in a large measure to the growth of other industries to which ice was a necessity. Before Croton water was introduced into New York, and as far back as 1825, ice was cut on Sunfish pond, on the outskirts of the city, by some butchers who desired to preserve their stock of meat. In 1826 ice was cut on Rockland Lake, and at first all the ice cut was stored in the ground, but later storehouses at Hubert street and Christopher street were built, and as the demand for ice gradually developed in all the larger Eastern cities, large storehouses were erected near the places where the ice was cut. The capacity of these houses ranges from 10,000 to 190,000 tons, and in size run from 100 to 150 feet in length by 30 to 50 feet in width. For gathering the ice there is an elaborate system of apparatus, but the usual methods employed are as follows: After the snow is cleared from the ice by means of scrapers or snow-plows, an ice-plow, either propelled by steam or drawn by horses — the latter means being more commonly used — cuts deep grooves in the ice in one direction and then repeats the operation at right angles with the first, thus forming rectangular pieces, measuring approximately 2 × 3½ feet. As these grooves extend nearly through the ice, it is a simple matter to saw through the remaining thickness, pry the cakes loose with crowbars and float them to the icehouses through channels opened up as the work proceeds. Upon reaching the icehouse the cakes are slid up an incline, with the aid of an endless chain apparatus, operated by horse or steam power; if the icehouse be very close, the same engine that runs the elevator may be used. The hoist or elevator of an icehouse is so located that ice may be conveniently slid to any part of the building. By means of an automatic indicator and trips the elevator is stopped at the proper height and the blocks of ice stored in layers. The floor of the house is built a little lower in the centre than at the sides, so that the weight of the ice may not lean on the walls. The walls are double and insulated to preserve the cold temperature inside.

The cost of harvesting a ton of natural ice varies greatly, it depending to a great extent upon the weather conditions, both during the process of the formation of the ice and during the process of cutting and housing. Under average conditions the cost of harvesting amounts to about 80 cents, though under favorable conditions it has cost only from 25 to 30 cents per ton, but this is exceptional. This, of course, does not include the cost of transportation, delivery, etc., and as the majority of the icehouses are a considerable distance from the centres of consumption, the cost of transportation is a large factor.

The moving of this enormous quantity of ice necessitates the maintenance of a large fleet of barges and other boats for the domestic trade, and of sailing vessels for the export trade, and to the cost of maintaining these vessels, when figuring the cost of harvesting, must be added the cost of towing, loading, discharging, dock and stable rent, repairs of boats, icehouses and wagons, etc., all this before the ice is placed in the hands of the retailer.

Since 1900 the natural crop has tended to reduction owing to increased use of artificial ice. Not much natural ice is now used south of Baltimore and Washington, and these cities use very large quantities of artificial ice.

The tools used in harvesting this crop are many and varied. Many of them were invented by Nathaniel Wyeth and John Barker of Boston. The ice plow was invented in 1839 and the patent clearing-tooth in 1872. Some of the most common tools now in use are: the snow-scraper or plane, the masher and the plow; augers and axes for tapping the ice in order to drain off surface waters; saws; forked bars for prying the cakes loose; various forms of hooks for handling the cakes; trimming bars for squaring the cakes after loose; adzes, edging tongs and chisels used in packing the ice when in the storehouse; saws and bars for prying loose previous to shipment; and tongs, scales, axes, etc., used on the retail delivery wagon.

Artificial Ice.— The manufacture of ice as an industry was begun as early as 1866, but only reached a degree of commercial importance about 1880. The beginning was naturally made in the Southern States, but as it became more generally used, factories sprang up over the entire country. The growth of the «infant industries» throughout the United States gave this industry an added stimulus, because the supply of natural ice was by far too small to meet the requirements of slaughtering and meat packing-houses, refrigerator cars, cold-storage warehouses, etc.

The first experiments for making artificial ice for mercantile uses started with the Italians in the 16th century. The first machine used for the actual manufacture was invented by Dr. William Cullen, this being based on the vacuum principle, the atmospheric pressure being reduced by means of an air pump. Later, in 1795, several experiments were made by a Mr. Walker of Oxford, England, in the line of freezing mixtures. Professor Leslie of England produced a considerable degree of refrigeration by including in the exhausted receiver of an air-pump sulphuric acid, a substance rapidly absorbing vapor. In 1834 Jacob Perkins, an American engineer residing in London, obtained a patent for a machine generally credited with being the forerunner of the modern compressor machine. The refrigerant used in this machine was ether and brine, and was circulated at a temperature of 5° Fahrenheit through pipes which encircled the evaporator containing the ether. After running through the pipes, the brine flowed into a receptacle containing boxes filled with water and thus the water was frozen. Later experiments were made by French and German inventors, boxes being supplanted by cans, and this developed into the manufacture of can ice. Many of the improvements made in the ice-making apparatus are due to the efforts of Prof. A. C. Twining of New Haven, Conn. He patented an ice machine in England in 1850 and in the United States in 1853; in 1855 he invented a machine and put it into active operation in Cleveland, Ohio, which produced 1,600 pounds of ice in 24 hours; and later discovered that ice would be transparent, with the exception of a small porous core, if frozen at a temperature slightly below the freezing point. In 1857 Dr. John Gorrie of Apalachicola, Fla., patented his ice-making machine; this was later followed by the compressed-air machine of Dr. Alexander Kirk; in 1858-60 the machine, upon which the modern ammonia absorption system was founded, was brought forth by Ferdinand P. E. Carre; and later the plate-ice system was introduced by Capt. David Smith of Chatham, Mass., who erected the first machine of this character in the United States at Oakland, Cal. There have been nearly 4,500 patents taken out in the United States alone for refrigeration processes.

Two systems of making ice are now used, the compressor and the absorption systems, the former the more generally used. The first step is the compression of the anhydrous ammonia (that is, ammonia which contains no water) by means of a steam pump, a pressure of from 125 to 175 pounds per square inch being exerted. This raises the boiling point of the ammonia. This pressure heats the ammonia and it gasifies as released. The next step is to reduce the gas to a liquid state by passing the ammonia through pipes which are in contact with the cold water or some other cold substance. By the condensation process the heat is greatly reduced and it loses theoretically all the heat it gained by compression. Thus the temperature of the ammonia falls to 5° or 10° F., and when it is circulated around tanks or cans containing water, the water freezes in a few hours. A good ammonia ice-machine will produce 30 pounds of ice with one pound of coal.

In the absorption process aqua ammonia is first converted into gas by the application of heat which raises the pressure to from 120 to 160 pounds per square inch. The ammonia is then reduced to liquid form by being passed through pipes in contact with cold water. The ammonia is then changed from a liquid to a gaseous form by expansion, the methods being the same as in the compressor system. The expansion draws out any heat in the gas, which, as it passes through the pipes in contact with the water to be frozen, absorbs the heat from them till they are of a like temperature.

A large portion of the ice manufactured in the United States is produced by the can system or the plate system. In making ice by the can system the water is first boiled and allowed to settle, in order to free the ice from any foreign substances and to reduce it to the greatest possible degree of purity. The water is then distilled, boiled again and run through three kinds of filters. A series of tanks, containing a strong solution of brine, is placed under the freezing room and through this brine run the pipes containing the liquefied ammonia gas. Into the tanks containing the brine are submerged the cans holding the water to be frozen. The ammonia in the pipes is expanded into gas as it passes into the brine and absorbs enough heat from the brine and water to form the water in the can into ice. The whole process requires from 20 to 66 hours, according to the size and weight of the blocks of ice and to the temperature of the brine. The can is then raised from the tanks by means of a hoist and dipped into a well of warm water to loosen the contents. The blocks produced weigh from 50 to 400 pounds.

The production of ice by the plate system is much slower and more cumbersome. In this process the tank contains the water to be frozen and into it is placed a hollow iron plate holding the coils of pipe filled with the freezing medium.

Thus the ice is formed on the outside of the iron plate, is taken out and removed and is then ready for use. The mechanism of an ice-plant consists mainly of a steam-boiler, feed-water conveniences, an oil-separator or high-pressure trap for removing the oil that collects in the ammonia, a steam-condenser, feed-water pump, an ice-machine, freezing tanks or cans and a cooling tower, where the heated water may be brought in contact with the atmosphere to quickly reduce its temperature.

The rapid growth of the artificial ice industry is most eloquently shown by the census figures. During the period between 1870 and 1880, the number of establishments increased from four to 35, and the production from a quarter million dollars worth to over half a million. During the next decade the number of factories increased from 35 to 222, and the production rose to almost $5,000,000 worth. Ten years later in 1900 the census records 787 establishments, with a capital of nearly $40,000,000, and an annual product of nearly $14,000,000 worth of artificial ice, most of this manufacture being in the Middle or Central States of the country. By 1905 the factories had increased to 1,320, the capital to $66,600,000, and the industry gave employment to over 12,000 people, receiving $5,550,000 in wages and salaries. The total production for the previous year was worth $23,790,000. In 1910 there were 2,004 factories, mostly capitalized between $20,000 and $100,000, and the production was valued at $42,453,000, while the wage earners increased to 16,000. In 1916 a conservative estimate places the total of factories at 2,500, and their production at $55,000,000 annually. Pennsylvania is the leading State in the industry, with 200 factories and 11.2 per cent of the country's production. Texas and New York each are credited with 8.9 per cent of the total production, but Texas has 200 factories to about 100 for New York State. Ohio, Indiana and Tennessee are the next States in the industry.

Strange to say the largest item of expense in the artificial ice industry is neither labor nor materials, as in most other manufactures. The material being water costs little and the machinery does the work. The great item of expense is coal, to produce the heat to expand the steam and run the compressor ice-machines.

The cost of producing a ton of ice averages throughout the country for all seasons of the year, between $1.00 and $1.50; the average price to the wholesaler ranges from $2 to $2.25; and the retail prices range from 15 to 40 cents per hundredweight according to the season. The changes and improvements in the methods of producing artificial ice have so reduced the cost of manufacture that it now competes with the natural product. See REFRIGERATION AND REFRIGERATING MACHINERY.

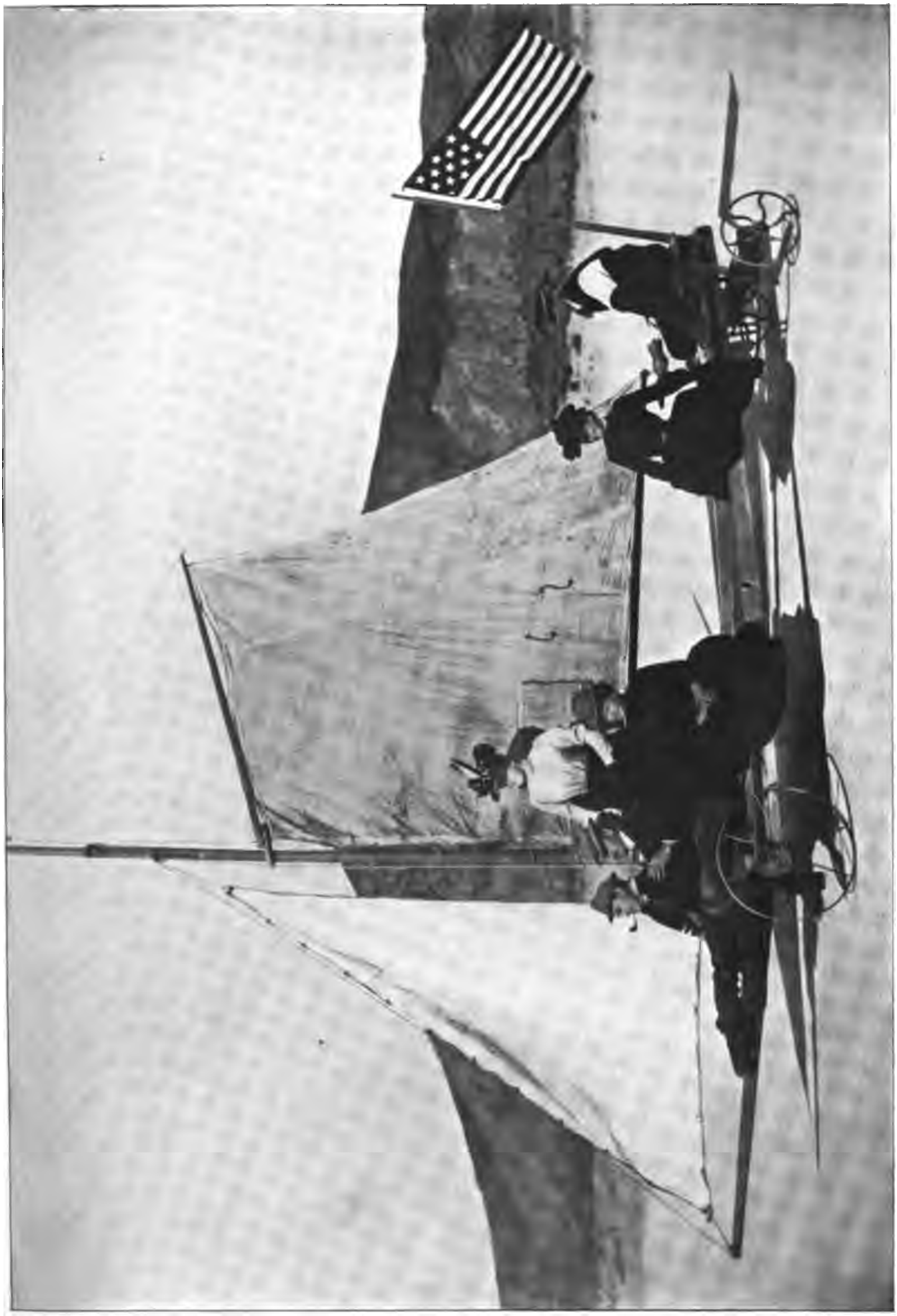
ICE IN MEDICINE. See COLD.

ICE PLANT (*Mesembryanthemum crystallinum*), a native of Africa and southern Europe. Its name is derived from the translucent shimmer of the bladder-shaped papillæ which cover the surface. The genus comprises 400 species, nearly all native to southern Africa. In southern California the ice plant is also successfully cultivated; and here, too, flourishes *M. æquilaterale*, a trailing species distinguished by attractive purple flowers. In the Madeira Islands, the seeds of the plant are eaten by the natives. When burned, it yields barilla, which contains carbonate of soda, valuable in the manufacture of soap and glass. *M. edule* yields the fruit known as Hottentot figs. The flowers of the ice plant are many petaled, colored white, red or yellow and the leaves are thick and compact.

ICE POLO, a game played on skates. It differs from ice hockey in that a ball is used instead of a puck; the stick is shaped differently and the formation and play are more open. The team is composed of five men, distributed as follows: one centre, one half back, one goal tend and two rushers. The rules vary slightly, the object of the game being similar to that of hockey. The rink is 150 feet long (i.e., the distance between goals), and the goals are four feet wide. The game is divided into halves of 20 minutes, with 10 minutes' intermission. One goal scores three points.

ICE YACHTS AND ICE YACHTING. The amusement or sport of sailing yachts over the ice has reached its highest development in the United States. The sport abroad is confined to Russia, Sweden and Norway. Boats of the Russian River Club are sailed over a portion of the Gulf of Finland. In 1901 the Stockholm Ice Yacht Club of Sweden built a fleet of fast-racing ice yachts from American designs by Ashley.

The first authentic ice boat in the United States was built by Oliver Booth at Poughkeepsie, N. Y., in 1790. It was a square box mounted on three runners, shod with rough iron, with a rudder post and tiller of wood. In 1850, on the Shrewsbury River, in New Jersey, George D. Allaire constructed an ice yacht of the box order, equipped with rough square iron bars for runners, sharpened with cutting edges. In 1855, on the same river, Nathan B. Clark built a three-cornered platform boat, having sharpened runners, and added a jib to the sprit sails previously carried. The type of side-rail boat came into use about 1871. Jacob Buckhout of Poughkeepsie was the pioneer designer of this type and at the Centennial Exhibition (1876) exhibited the side-rail yacht *Whiff*, built for Irving Grinnell of the New Hamburgh, N. Y., Ice Yacht Club. She carried 347 square feet of canvas and measured 40 feet from the top of the bowsprit to the end of the main-boom. The sloop-rigged *Icicle* built on these lines carried 1,070 square feet of sail, but this excess of canvas was found impracticable and the building of large boats was abandoned. The revolution in ice yachting began in 1879, when H. Relyea of Poughkeepsie built the *Robert Scott*, having a single backbone and an elliptical steering box. This boat carried 499 square feet of canvass and easily outsailed boats of twice her size. In 1883 the *Jack Frost* was built by Archibald Rogers of Hyde Park-on-the-Hudson and the famous racing yacht *Haze* was built the same year. The *Jack Frost* won the world's pennant in 1883 and the *Haze* in 1884 and 1885. About this time the Shrewsbury Ice Yacht Club of Red Bank, N. J., built a large lateen-rigged boat, the *Scud*, carrying over 600 square feet of duck in a single sail. The Orange Lake, N. Y., Club built at the same time the catboat *Shadow*, carrying 800 square feet of sail and said to be the strongest ice



"Ice-boating" on the Mojave Desert, Southern California. The "ice" is the compact sand of an ancient salt lake, now 2000 feet above sea-level

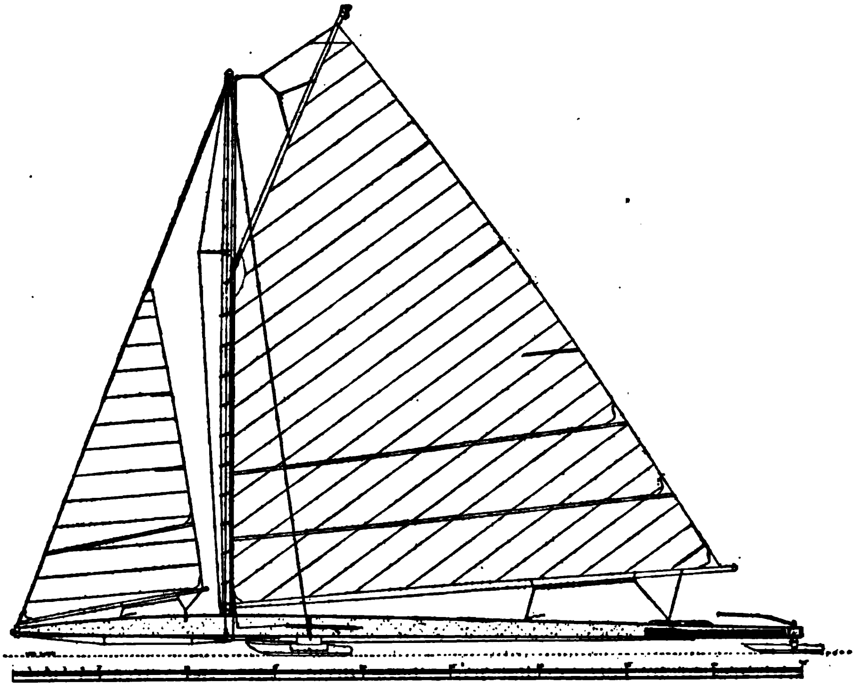
yacht ever constructed. Both of these vessels proved unsuccessful as prize or pennant winners. The *Icide,* owned by J. A. Roosevelt, took the American pennant in four races out of five in the years between 1888 and 1899. The *Jack Frost,* owned by Archibald Rogers, won the pennant in 1887, 1893 and 1902. In March 1904, the *Wolverine* won the Stuart International Trophy, over a 20-mile course. In the last heat the time made was 42 minutes. On 24 Feb. 1907, the same yacht broke all world's records for a two-point course, at Kalamazoo, Mich., making the 20 miles in 39 minutes and 50 seconds, which remains as a record.

Racing Rules.— For class racing, ice yachts are divided into four classes: (1) Yachts carrying 600 square feet of sail area and over. (2) Yachts carrying 450 square feet and under 600. (3) Yachts carrying 300 square feet and under 450. (4) Yachts carrying less than 300 square feet. Handicap or time allowance for mixed classes is made as follows: One second per square foot for every foot of canvas carried over the smaller boat, providing the race is sailed in one hour. If the race is sailed in 30 minutes one-half second per square foot is allowed and proportionately in accordance with the time of the race.

The course is usually a triangle, sailed over as required to make the number of stated miles; or a straight course to windward and return or to leeward and return. The standard distances for ice-yacht races are 20 miles, 15 miles or five miles. The larger the yacht the longer the course. Time limit: 20 miles, 1 hour 15 minutes; 15 miles, 35 minutes; 5 miles, 20 minutes.

In the United States and Canada there are many ice-yacht clubs. The challenge pennant of America is open to any American or foreign built yacht.

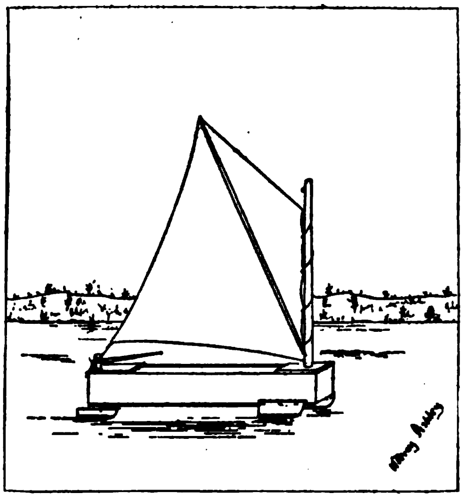
Ice Yacht Construction.— In the modern ice yacht the centre timber or backbone may be made of two pieces joined, or of one solid stick or as a hollow truss. To this is joined at right angles the running plank, which is supported by the two principal runners; the third runner is placed aft on a pivot and operated by a tiller as a rudder. The cabin, steering box or cockpit is attached at the aft extremity of the backbone. The mast is stepped two or three feet forward of the running plank. The backbone running plank, mast and bowsprit are connected and braced by wire ropes. The best material for the main beams is seasoned basswood, which is very light and stiff. The central objects in construction are lightness and strength and adaptability for perfect handling. The centre of sail balance should agree with the centre of balance of the hull.



A Modern and Expensive Ice Yacht.

The cost of building an ice yacht of the first class, carrying about 650 square feet, is $1,200 and of the fourth class, carrying 300 square feet, about $350.

Sailing.— Racing on a lake is preferred to river racing, as there are neither tides nor ice cracks to interfere. Besides the sailing on the Shrewsbury and Hudson rivers there is now regular sailing and occasional racing on Lake Champlain, New York; Lake Minnetonka and Lake Pepin, Minnesota; Lake Winnebago, Wisconsin; Gull Lake, near Kalamazoo, Michigan, and the shores of Lakes Erie and Ontario. The 1914 races were sailed on the Shrewsbury, R. Heitemeyer's *Imp* winning the American pennant in 40 minutes 5 seconds. In a 10-mile race off Red Bank the *Scud* offered 7 minutes handicap to all comers, but lost to the *Imp.* The 15-mile race for the Heitemeyer Cup was won by W. Content's *Blanche* in 35 minutes 35 seconds. In sailing a yacht the sheets are trimmed flat. The closest a boat will go to the wind is 30 degrees or 2⅔ points. The best course, or the one that will take the yacht farthest to windward is 60 degrees or 5⅓ points from the wind, when the advance to windward should be at the rate of half the velocity of the wind, while the actual velocity is equal to that of the wind. The yacht encounters the greatest velocity of the wind when her course is 90 degrees or 8 points from the wind, when the apparent wind is twice the actual velocity. The greatest speed of the boat is attained at 120 degrees or 10⅔ points from the wind, when her speed is twice that of the wind. The most rapid progress to leeward is made at 150 degrees or 13⅓ points from the wind, when the apparent velocity of the wind will equal its true velocity.



Ice Boat of 1790.

ICEBERG, a mass of floating ice, usually detached from the front of a glacier, though the term is also applied to floe ice that has frozen on the surface of the ocean and then broken up. The fronts of many Alaskan and Greenland glaciers are discharging icebergs almost continuously. The ice masses may break away from the glacier as a result of undermining by waves, as a result of large blocks shearing away from the ice cliffs due to their weight and the great height of the cliff (300 to 500 feet in some cases), or as a result of the buoyant effect of the deep water into which they flow.

Ice in the north Atlantic occurs in three forms: slab ice, ice fields and icebergs. Slab ice is sea-ice formed in the river mouths, as in Labrador, occurring in sheet or circular masses. Ice fields are caused by the freezing of the sea itself and come usually from Labrador, though occasionally from Greenland. These two forms are not particularly dangerous to mariners, but may become so by massing or freezing to an unusual thickness. Icebergs, however, which are always freshwater ice, are never anything but dangerous, and constitute the deadliest menace to navigation that ships have to face.

All the icebergs that are so perilous to travel in the transatlantic routes come from Greenland, in the neighborhool of Melville Bay, or outlying islands. Greenland is itself a huge, dome-shaped island covered with an ice-cap in places probably more than a mile in thickness. The western slope is far more extensive and it is on this side that most of the icebergs are formed; those that are made on the east coast are smaller, fewer in number, and, being quickly broken up by the open Atlantic waves, melt before they float far south.

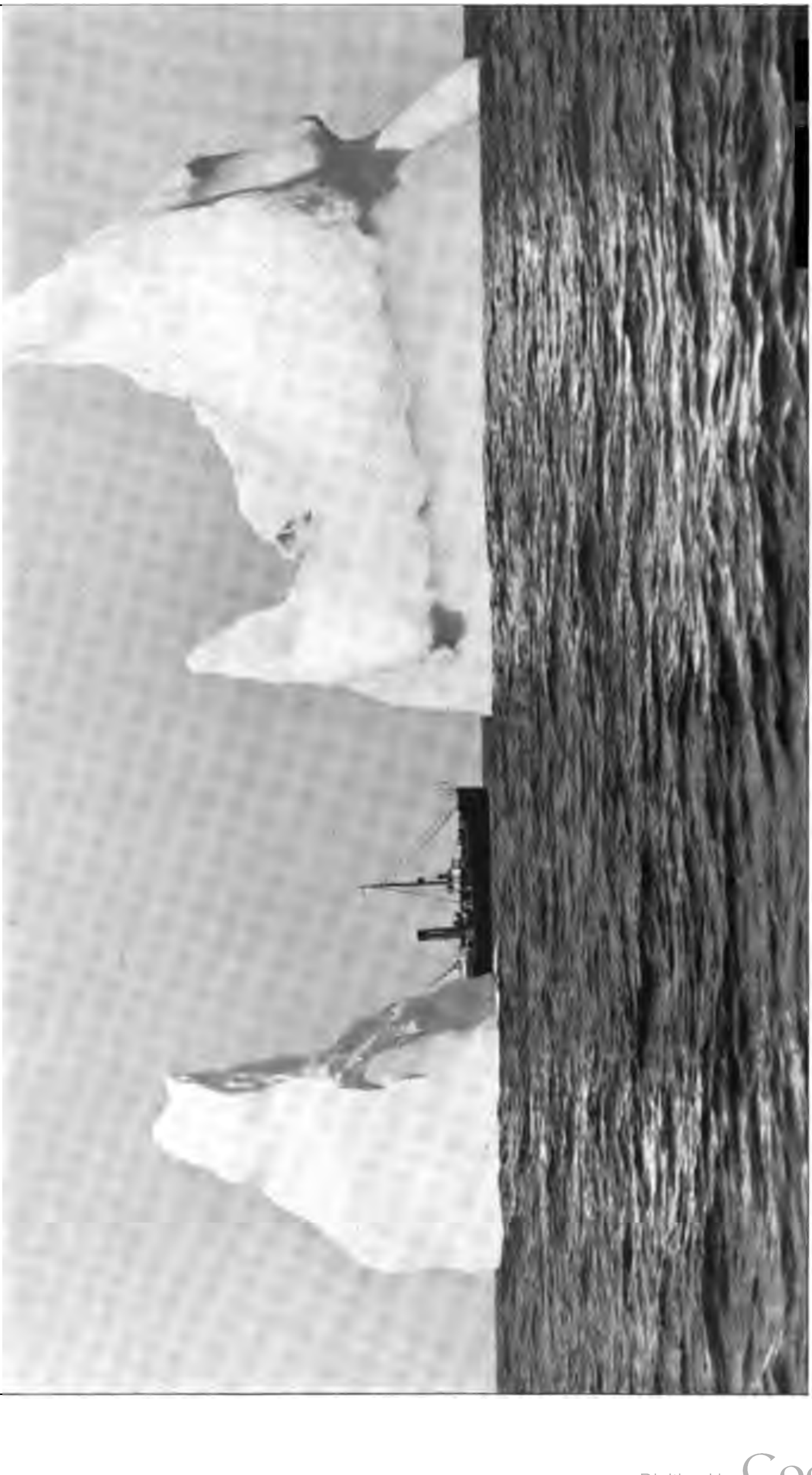
The immense glaciers on the West Greenland side are constantly descending and push out to sea in enormous «tongues,» as they find their way down the ice-covered mountains. These «tongues» form icebergs in three ways. Masses of ice may simply break off of their own weight; the sea waves may undermine the «tongue» until the weight of overhanging ice causes it to fall into the sea — a process called «calving»; or the ground swell of the ocean may dislodge large blocks of ice from the base of the glaciers. This glacier ice is unlike any other, having become exceedingly hard and flintlike from the enormous pressure; and, mingled with it, on the underside, are often boulders, stones, soil and other detritus. This is the birth of the iceberg — masses of ice of all shapes and sizes, launched into the sea every day of the year, but most generously in the short Arctic summer and contributed to by every mile of coast from Cape Farewell to Disco Bay, tributary to 120,000 square miles of ice cap. There is a single glacier that furnishes 200,000,000,000 cubic feet annually in icebergs.

These icebergs, as released, drift across the entrance of Baffin's Bay and Davis Strait to the Labrador coast. Here they catch the Labrador current and drift slowly southward on a journey of weeks or months — that is, for those that manage to escape to the open. The great majority of them become grounded or are immeshed by the numerous islands and bays that mercifully line the Labrador coast and protect the Atlantic in large measure from the iceberg menace. Those that finally make their way through — and they are countless in number — divide into two streams, one passing through the Strait of Belle Isle into the Gulf of Saint Lawrence, and the other, much the larger, going to sea by the way of the Grand Banks of Newfoundland. The «Banks,» it is interesting to note, have been formed, it is thought, by the detritus brought down from Greenland by icebergs through unnumbered ages and dropped here, as the icebergs disintegrated, to become the breeding ground of cod, herring and other fish used by man.

When icebergs reach this point, they seem of every size, shape and contour, some of them rising to a hundred or more feet in height, with spires of crests or «minarets» 200 to 300 feet above the base, which may be hundreds of yards in length. From one-eighth to one-ninth of the *mass* — not necessarily height — lies above water. It must be remembered that mass and height are very different qualities. It is quite possible that an iceberg is disintegrating in such a way that it is as high out of the water as it is deep below the surface.

Icebergs reach the transatlantic routes in

ICEBERGS



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Gigantic Icebergs in the North Atlantic discovered by the United States Revenue Cutter *Seneca*, Easter Sunday, April 12, 1914

greatest numbers in April, May and June, but may be met with earlier and later. During the months named a more southern route is chosen by the ocean steamships. The place of most frequent contact with icebergs is at latitude 42° 45′ and longitude 47° 52′, where the Labrador current meets the Gulf Stream. It was at about this point that the *Titanic* met her fate in April 1912. The iceberg peril is lessened by the issuance of monthly "pilot charts" through the United States Hydrographic Office, which locate ice fields observed the previous month. Little reliance can be placed on the various devices invented to detect the vicinity of icebergs in foggy weather, though an "echo recorder" has been invented which is sometimes of service. But in spite of all precautions icebergs may creep upon a mariner unawares, and, with fog, are his deadliest peril.

Icebergs disintegrate very rapidly, beginning almost as soon as they are afloat. This is due in part to the fact that there is so marked a difference between the tension of the exterior and interior portions of such a mass of ice. The water that melts on an iceberg during the day works its way into crevices, and then, freezing at night, expands and splits the ice, often violently. After the icebergs get out of the Labrador current, disintegration goes on naturally and much more rapidly. They finally disappear about 400 miles south of Nova Scotia, the "Graveyard of the Iceberg," a point which they have to travel over 2,000 miles to reach.

ICELAND. An island in the north Atlantic Ocean, on the border of the Arctic Circle, 200 miles east of Greenland. It is an autonomous dependency of Denmark. Its volcanoes, earthquakes and geysers, its lava deserts and glacial snowfields make it an almost impossible land for human occupancy.

Area and Physiography.— Iceland is situated between 13° 22′ and 24° 35′ west longitude and extends from 63° 12′ to 66° 33′ north latitude. Approximately 300 miles from east to west and 200 from north to south, its area is about 40,450 square miles. Its coast line of 3,700 miles is deeply and irregularly indented by fiords, those of the northwestern peninsula being especially numerous. Three-fourths of the area is on the main island; the remaining portion is that of the northwest peninsula, which barely escapes being an island, as the connecting isthmus is only a few miles wide. This peninsula is largely mountain masses, with an average elevation of 2,000 feet. The main island is a series of volcanic tablelands, high and irregular, ranging from 1,500 to 3,000 feet above the sea. Overlaid here by extensive lava-beds and there by vast névés, or snow-fields, these plateaus present great areas of barrenness devoid of vegetation and are also broken up by ridges, fissures and spurs. More than one-eighth of Iceland is covered by lava-beds and another eighth by névés or glaciers. The only areas suitable for human habitation and industry are the bordering lowlands of the ocean and fiords, with the adjacent fertile valleys. Among the many mountains the highest are Oræfa, 6,424 feet, and Hecla, 5,108 feet. Lakes are numerous though of small size, the largest being Thingvalla and Thors, each less than 30 miles in area. The so-called crater lakes, especially those to the west of Vatna, are subject to sudden and violent displacements through volcanic action. Pasturage for herds and arable lands are almost entirely confined to valleys near the fiords.

Climate.— Iceland's climate is typically insular — equable and humid, with cool summers and warm winters. The following data compiled from observations of many years at Stykkisholm, 65° N., closely represent all of the island. The monthly averages of temperature, number of rainy days and amount of rainfall are: January, 50°, 20, and 2.76 inches; February, 27°, 18, 2.48; March, 27°, 18, 1.93; April, 34°, 16, 1.22; May, 40°, 15, 1.38 June, 47°, 16, 1.57; July, 50°, 13, 1.34; August, 49°, 14, 1.54; September, 45°, 18, 2.99; October, 38°, 19, 2.76; November, 33°, 18, 2.28; December, 28°, 20, 2.32. The coast temperatures differ slightly from those given, but on the central tableland vary from two to six degrees warmer in summer, and that much colder in winter. The annual rainfall of the southeastern shores averages 46 inches or more, while that of Grimsey Island, off the north coast, falls to 15 inches.

Fauna and Flora.— The woods are represented only by birch, mountain ash and willow, all stunted; trees more than 20 feet high are rare. The floral species number 435 and pertain to the Arctic flora of Europe. Indigenous animals are the blue and white foxes, visiting polar bears and mice. Wild reindeer are from the herds introduced in the 18th century. Of the 100 birds, the majority are aquatic. The most valued is the eider duck, for the down with which it lines its nest.

Volcanoes.— The physical features and material prosperity of Iceland have been largely dominated by its volcanoes, whether active or quiescent. During inactive periods the drifting ashes and cinders often destroy the fertility of fields and the pastoral ranges. From the eruptions have come vast masses of lava, which have transformed by their unbroken sheets thousand of square miles of cultivated valleys into desolate deserts. The fearful devastation wrought by eruptions has scarcely been surpassed elsewhere. In two centuries (1625–1860) Katla has been active 13 times, once sending its ashes to Norway. On occasion the lava streams from this volcano melted enormous masses of névé, causing violent floods which through its débris changed many farms into barren wastes. As late as 1875 Askja sent forth great rivers of lava from its crater of 34 square miles.

The most frequent eruptions have been from Hecla, which numbered 43 periods of activity up to 1845; they were generally violent. The outflow of 1783 wasted a large extent of country, while that of 1845 continued at intervals for nearly a year, pouring out a lava stream 50 feet deep and a mile wide.

Hecla has the record for devastation, its single eruption (1783) causing almost inconceivable havoc. It is asserted that no less than 230,000 head of stock were killed, including more than half of the cattle, three-fourths of the horses and four-fifths of the sheep. These frightful losses of fields and of stock caused famine to fall on the land, and in succeeding years 9,500 persons died of starvation, one-fifth of the entire population.

Earthquakes are naturally associated with volcanic energy, though not directly connected with it. The earthquake of 1784 destroyed 92 homesteads and injured 372 others. The damage of that of 1896 was fully as great, half of the 320 homesteads affected being destroyed. The lava beds work the greatest injury, as they gradually diminish the arable and pastural areas of the island. The greatest lava producers have been Askja, Hecla and Katla; these parent volcanoes are encircled by lava sheets which aggregate in area nearly 5,000 square miles. The Odadahrum field, to the north of Vatna, is an unbroken sheet of 1,700 square miles, including branches. One danger is the melting of the surrounding névés by the burning lava, thus producing devastating inundations. The most destructive of such floods was caused by the eruption of Oearefa Tokeell (1362), when 40 farms with occupants and stock were swept bodily into the ocean.

Glaciers and Névés.— There are 200 or more of névés, or permanent snow-fields, the most extensive, 2,300 square miles being that of Vatna, which borders the Atlantic. While the northern snow-line of Vatna, facing the Arctic Ocean, is at an elevation of 4,000 feet or more, the southerly snow-bearing winds of the North Atlantic are so effective that they bring the névé of the oceanic slopes down to 2,000 feet. From this névé issues a glacier of nearly 200 square miles area. Practically all the glaciers are dead, that is do not reach the sea, though the Breidenmerkur closely approaches the Atlantic. On the Arctic and coldest coast, the lowest glacier terminal is 2,500 feet above the ocean.

Geysers.— Hot springs exist in large numbers, and are of three types: quiescent springs, boiling mud lakes, and geysers where boiling water is ejected intermittingly. The largest geyser system — numbering a hundred — is about 60 miles northwest of Hecla, and 70 miles from Reikjavik. The best known are the Great and Little Geysers, and Storkr (the churn). The Great Geyser is surrounded by a silicate basin, 70 feet across and 5 feet deep. The vent extends 80 feet downward, and its diameter is about 8 feet. At irregular intervals, varying from 6 to 30 hours, the Great Geyser ejects with a roar a column of boiling water to great heights — 80 to 150 feet. The surface water usually has a temperature near 180°, but occasionally reaches 250°.

Agriculture, Fisheries and Industries.— About 50,000 persons are engaged in agriculture, of whom a surprisingly large number are owners. Hay is the principal crop, followed by potatoes and turnips. Berries are the only native fruits. Stock-raising is the important factor. In 1914 there were 1,021 goats, 25,380 cattle, 46,644 horses and 585,022 sheep. Grain cannot be profitably grown, thus necessitating importation of cereals. The most important of the exports are the products of the deep-sea fisheries, in which 15,890 persons were engaged in 1914. Cod is the most lucrative, followed by herring and salmon. Industries are limited, only 7 per cent being employed therein. The principal industries are the curing and salting of fish, rendering of oil, preparation of eiderdown and the manufacture — largely domestic — of woolen cloth for local use.

Minerals.— Difficulties of transportation and poverty of metallic deposits have delayed the exploitation of the minerals of Iceland. In recent years a mine of the well-known Iceland spar has been developed, and with the growing demand for fuel the mining of the low-grade coal is also being attempted.

Communications.— Keeping pace with inventions, Iceland has emerged from the period of bridle-paths and infrequent mails. Bridges and roads now exist, and the introduction of motors compels further progress. Cable communication with Europe is supplemented by a network of telegraph and telephone lines; this system, 862 miles in length, has about 90 stations in operation. The coast settlements are served by regular steamship lines.

Government.— The Minister of Iceland controls such affairs as pertain to Denmark, by whose king he is appointed. His tenure of office depends on the support of the Althing. (See *History*). Iceland votes its own budget, levies its own taxes, and imposes duties on coffee, sugar and tobacco. Its expenditures are kept within its receipts, and there is no public debt. A reserve fund for emergencies exceeds one million kroner.

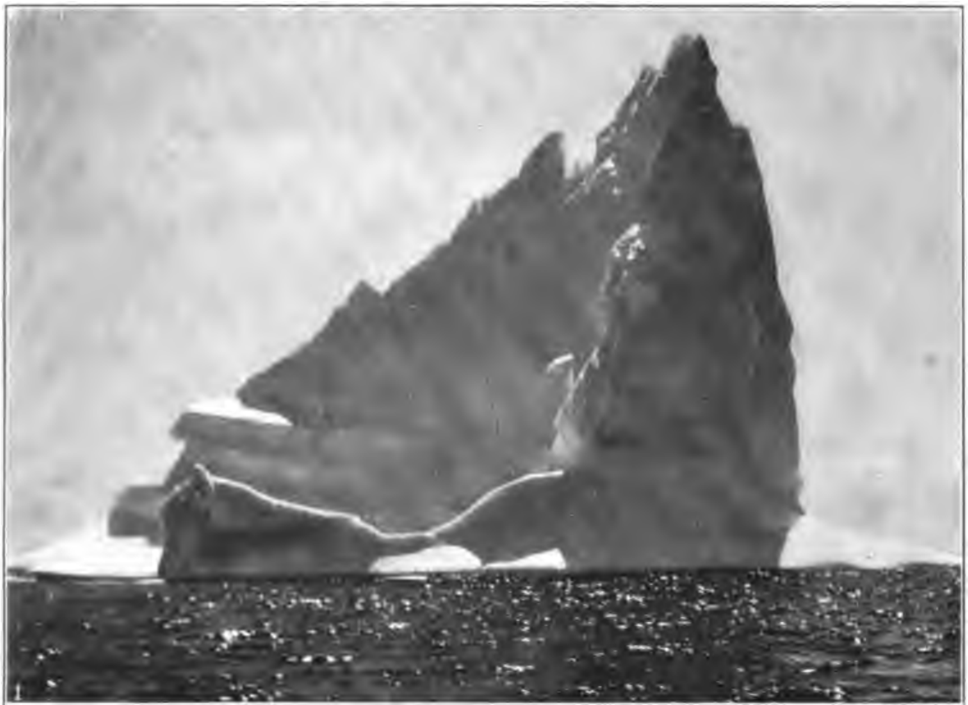
Commerce.— Until 1854 trade was a Danish monopoly. At present 40 per cent is Danish, 25 English, and 10 Norwegian. The larger part of the cargoes are carried in English bottoms. The value of the imports (1913) reached 16,717,000 kroner: they consisted principally of cereals, 12 per cent; clothes, etc., 14 per cent; coal, 15 per cent; and wood materials, 7 per cent. The exports (1913) aggregated 19,128,000 kroner. Of this fish amounted to 64 per cent, mutton to 10, oil and hides, 5 each, horses and eider-down about 1 per cent each.

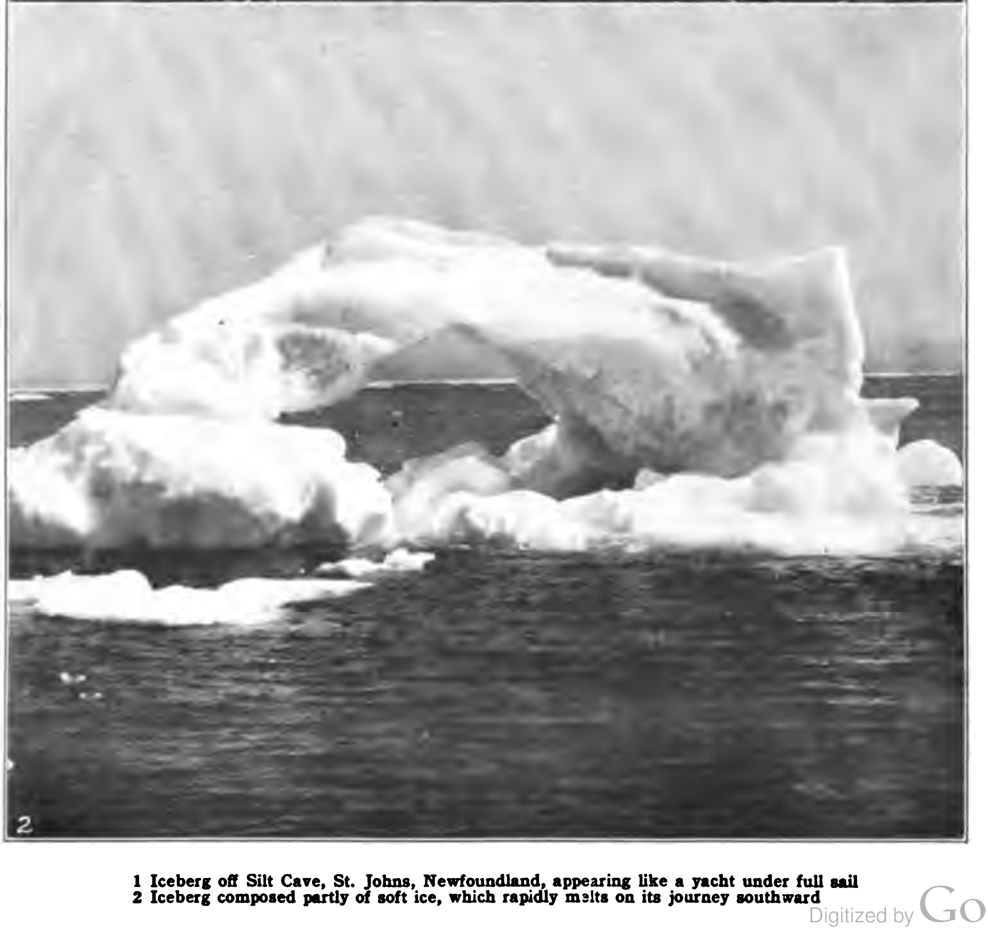
Population.— The inhabitants of Iceland are Scandinavian by race and Lutheran by religion. Once said to number 100,000, they were reduced by famine and epidemics to 47,240 in 1801. The population increased steadily to 72,445 in 1880, but fell off the following decade to 70,927 through an epidemic of measles and by emigration to America. The census of 1911 registered 85,133, and doubtless the number now exceeds 90,000, as the 2,333 births of 1914 exceeded the deaths by 904. The Icelanders are educated, intelligent and temperate. Thrift is shown by the saving-banks where the deposits approximate $1,500,000. More than one-half the population are agriculturists, and one sixth are engaged in deepsea fisheries.

Education.— In the remote and rural districts the education of children begins at home, aided by traveling teachers and supervised by the clergy. Wherever there is a village or town a regular school system is maintained. Reikjavik is the seat of higher education, headed by a theological seminary and a university. Technical schools are maintained for medicine, navigation, agriculture (there are four on the island), Latin and advanced training for women. There are about 20 Icelandic newspapers and journals, which are widely distributed and diligently read.

History.— The definite history of Iceland begins with its settlement in the 9th century by Norwegians, whose emigration was forced by the tyrannical oppression of King Harald Fairhair. The colonists came in clans, their home chieftains ruling selected districts in the new land. These chiefs soon established a representative government, organizing the Althing in which all Iceland participated. For two centuries the laws there made were promulgated

ICEBERGS





1 Iceberg off Silt Cave, St. Johns, Newfoundland, appearing like a yacht under full sail
2 Iceberg composed partly of soft ice, which rapidly melts on its journey southward

orally and handed down by memorizing. The introduction of Christianity, in the year 1000, was followed by the development of a rich and remarkable literature. Feudal quarrels and religious dissensions, fostered by the king of Norway, led to civil war. Through emissaries, by means of assassination and bribery, the Althing was influenced to ratify (1264) a Treaty of Union with Norway, safeguarding Icelandic liberties by provisos retaining powers of taxation and of law-making. In 1380, through changes in the Scandinavian dynasty, Iceland passed under control of Denmark.

The epidemic of Black Death (1402–04) threatened extinction, while later famines, piratical raids, smallpox (1707) and volcanic eruptions (especially in 1783) brought untold misery on the people. After an existence of over eight centuries the Althing was abolished (1800), and home government seemed to have perished. But patriotism was not dead, and after years of struggle the Althing was restored in 1843. Denmark attempting (1849) to restrict Icelandic liberty, a constitutional struggle followed, which terminated (1874) by the granting of a constitution. This reformation was accomplished under the leadership of Jon Sigurdsson, on whose monument is engraved, «Iceland's beloved son, her honour, sword and shield.» While the Althing was largely elective, the Upper House was formed by 12 members, of whom six were nominated by the king of Denmark, who also appointed the governor. The Crown however exercised very freely its power of veto on Icelandic measures, which led to further struggles. Finally Denmark granted a liberal constitution (1903), under which the Minister of Iceland resides in the country, and depends for his tenure of office on the support of a majority of the Althing. This body now consists of a Lower House, 26 elective members, and the Upper House, with eight of its members elective and six nominated. Icelandic affairs are now largely independent of Danish control. The autonomy of the island is also evident from the royal assent given to the Icelandic national flag, a white cross, with a stripe of red, in a blue field. The measure giving women the right of suffrage receiving royal approval 19 July 1915. On 25 Jan. 1915 the Althing enacted a law forbidding sales of liquors, under which all remaining stock of liquor was exported. Progress is the order of the day, and complete independence is now urged.

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ICELAND MOSS, a lichen (*Cetraria islandica*), found in all the northern parts of the world. It is valued for its nutritious and medicinal properties, and as an article of commerce is collected in Iceland and Norway. In the extreme north it grows even near the sea-level; farther south, only on the mountains. In Iceland it often thickly covers great tracts, and the gathering of it is a summer industry. It grows about one and one-half to four inches high, consists of an almost erect thallus, and is of a substance leathery and rather cartilaginous. It has a bitter principle which is reduced by steeping in water, and the moss is prepared as food either by pounding and making it into bread or by boiling, with water or milk, till it makes a jelly, in which form it is an agreeable and beneficial diet in some forms of disease, especially in pulmonary disorders. It is also utilized in dressing the warp in weaving, and for sizing paper, being mixed in the vat with pulp. It is also of value as one of the foods of the northern caribou.

ICELANDIC LANGUAGE. The Icelandic language is a member of the Scandinavian branch of Germanic languages. Together with Old Norwegian as spoken in Norway and in her Western colonies, the modern Norwegian dialects, and Faroish it forms the Western Scandinavian group, while Swedish and Danish form the Eastern. (See DANISH LANGUAGE). The original settlers in Iceland came from Norway direct or from the Norwegian colonies on the islands north of Scotland. The majority were from southwestern Norway, and with the dialect of this section of Norway the Icelandic language remained most closely related till the 14th century, from which time Icelandic is a language separate from Norwegian. Owing to the island's isolated location, the Icelanders have for a longer time than other countries preserved old habits and customs, and particularly has the ancient language been retained with comparatively few changes. The population has at no time exceeded 100,000, while about 25,000 have in recent years found new homes on the North American continent, about equally divided between Canada and the United States. But the language and literature of this people, so insignificant in number, are of the greatest interest and value.

The history of the Icelandic language may be divided into two periods: Old Icelandic (874 to the time of the Reformation) and Modern Icelandic. In the so-called classical period, from the latter half of the 12th century to 1350, the language of Iceland and Norway was often called «Norrönt mál» (Norse tongue). The «Norn» language is still used about what remains of the Norwegian language on the Shetland Islands (cf. Jakob Jakobsen's ‘Etymologisk Ordbog over det norröne Sprog paa Shetland’). While changes common to the language of Norway and Iceland are developed in this period, there are also certain characteristics in Icelandic distinguished from Norwegian (see NORWEGIAN LANGUAGE), but as by far the most important literature was either produced or preserved in manuscript in Iceland, the Icelandic form became the standard, and even in Norway Old Norwegian is taught in the schools in the Icelandic form. Some differences between Norwegian and Icelandic are: u-mutation of *a* is found in Norwegian only when *u* is dropped in the following syllable, in Icelandic both when it is dropped and when it is retained (Icelandic *forum*, Norwegian *farum*); original *h* has been retained in Icelandic (even till this day) before *l*, *n* and *r*, while in Norwegian *h* was dropped (Icelandic *hlutr*, Norwegian *lutr*; Icelandic *hniga*, Norwegian *niga*);

ō (*œ*) becomes (13th century) in Icelandic (ae) (*norröna*, Icelandic *norræna*); later, *e* before ng is changed to *ei* in Icelandic. The classical Icelandic was practically uniform throughout the island, with very few dialectic differences. This was owing to the lively intercourse between the different settlements of the island and between these and the mother country, to the annual Althing gatherings and to the flourishing literature. As a literary language it takes the highest rank among the old Scandinavian languages not only on account of its wealth of literary treasures, but also on account of its pliancy, its expressive and elegant style. Both the valuable literary productions and the retention, on the whole, of the more ancient forms give it a fundamental importance for the study of Scandinavian languages and literatures in all their branches. Even at an early date their language became to the Icelanders an object of scientific study, as seen, e.g., in the so-called 'First Grammatical Treatise' in Snorre's 'Edda,' written by an unknown scholar in the 12th century. From the 14th century, Middle Icelandic falls far below the Classical in power and grace. From the orthography, often inconsistent and a mixture of old and new, is seen the transition to the pronunciation which is characteristic of Modern Icelandic. A considerable number of foreign words make their appearance, borrowed from French, German and Danish.

Modern Icelandic as written does not differ very much from Old. Especially from the 19th century, it has in the main retained the orthography of classical Icelandic, while in its earlier periods the orthography resembled more the Middle and was closer to the pronunciation. In this respect it differs very much from Old Icelandic. A number of the vowel sounds have changed. One example: *á* is spoken as the diphthong *au* and before *tt* almost as German *ach*. The same is true about the consonants. Examples: *ll* (in certain cases) and *rl* spoken is *dl*. The same sounds as in English *th* in «father» and «think» have þ and ð retained. The accent is on the first syllable. As to the vocabulary, the modern Icelanders have with passionate zeal practised the exclusion of all foreign words and have formed new words, as occasion demanded it, from native material. There is, on the whole, much similarity between linguistic conditions in modern Greece and modern Iceland. The result of this purism so consistently carried out is that modern Icelandic has fewer words of foreign origin than any other language. New words have in many cases been coined successfully, as *bókasafn* (library), *umræda* (discussion). But in a number of cases these attempts have not been so successful. Where it is impossible to coin new words from Icelandic material, the strictest purists would rather avoid the use of the word or use an Icelandic word that has a somewhat similar significance.

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ICELANDIC LITERATURE — Old Icelandic (800–1500).— The old Icelandic poetry is a development of the old Norwegian, which, however, it soon surpassed. From the middle of the 10th century almost all the skalds (poets) are Icelanders. After the famous Norwegian Eyvind Skaldaspillir, whose 'Hákonarmál,' composed in memory of King Hakon (d. 961) is one of the finest songs handed down from the past, poetic art almost ceased among the Norwegians while it flourished among the Icelanders. The Elder Edda or Sæmund's Edda is a collection of lays, treating of gods and heroes of antiquity. In these famous poems together with the Younger or Snorre's Edda we find the principal sources of our knowledge of Scandinavian and, indeed, Germanic mythology. Many scholars have in recent times discussed both the age and what was the probable original home of the Eddaic poems. The consensus now is that the oldest are from the latter half of the 9th century, and that most of them came from the 10th and the early part of the 11th century. Their original home is Norway and her colonies, and of these principally Iceland, where they were preserved in their written form. Related to the Eddaic lays whose authors are unknown, is the poetry of the known skalds. These poems treat of a variety of themes. Joy and grief, love and hatred find expression in them, but the majority are composed in honor of kings and princes, in whose presence the skald himself recited his poem. The Icelandic skald would visit especially Norway, but also Sweden, Denmark and the British Isles. The princes gave them as a rule a hearty welcome and rewarded them liberally. These poems of praise and songs of heroic deeds often have great historical value, superior to the artistic, and in the sagas are found frequent quotations from them in support of the story. Simple rules of versification, as a rule, governed the lays of the Edda. In the age of the skalds it is much more artificial, bordering sometimes on the incredible. Combined with the rules, to be strictly observed, of metre, alliteration and rhyme was developed an elaborate system of complicated figurative paraphrases (*kenningar*). All this artificiality is far removed from the noble simplicity of early poetry and often makes the skaldic verses unintelligible. To a number of these enigmas, the Skáldskaparmál of Snorre's Edda furnishes the key.

The first great poet of Iceland was Egil Skallagrimsson, the hero of one of the best sagas. This famous viking of the 10th century was both a great skald and a mighty warrior. Of his poems that have been preserved 'Sonartorrek' ('Loss of the Son') bears the best evidence of his great poetic gifts. In his 'Warriors of Helgeland' Ibsen has imitated it. Glum Geirason composed a poem in memory of the Norwegian king Harald Graafeld and was the first Icelandic skald to compose a poem in praise of a king. Soon this species of poetry was exclusively confined to the Icelanders. But there are also poems of a different kind, as the love songs of Kormak Agmundsson and Gunnlaug Ormstunga who visited Norway in the time of Earl Haakon (d. 995). Hallfred Vandrædaskald composed poems in honor of King Olav Tryggvesson (1000). Thormod Kolbrunarskald was one of Saint Olaf's skalds and fell in the same battle as his master (1030). Most famous of all Icelandic skalds is Sigvat Thordsson, who made his home in Norway and was strongly attached both to Saint Olaf and his son Magnus. Best known are his 'Bersöglisvisur' (songs of free speech). Arnor Thordsson and Tjodolf Arnorson were attached to King Harald Hardradi who also was a poet. Of the many poets after the time of King Harald must be mentioned the great historian Snorre Sturlasson who wrote in honor of King Hakon and Earl Skule, his well-known 'Háttatal' (enumeration of metres) in 102 different kinds of verses. Snorre's nephew Sturla Thordsson is the last poet who is known to have composed songs in honor of Norwegian kings ('Hakonarkvida'). In all these songs of praise which principally glorify the warlike deeds of kings and princes, we find comparatively few traces of the changes brought about in customs and views by the acceptance of Christianity. Even in the drápas that were produced after the introduction of Christianity figurative language and expressions are used which get their explanation from the myths of heathen gods and heroes. But it is clear that sooner or later the new religion would furnish the poets new material. Most remarkable and, perhaps, the oldest in this respect is 'Solarljod' ('Song of the Sun'). Even this Christian poem, giving visions of heaven, purgatory and hell, uses much of the heathen material. But it was easy to transfer the practice of singing the praise of kings and warriors to the religious field. Christ and the Saints were looked upon as heroes and warriors. The last and most famous of these religious poems is Eystein Asgrimsson's 'Lilja' ('The Lily'), written about 1360. In an original metre, later called the Lily metre, it glorifies the Savior and Virgin Mary. In 1917 were published excellent translations into modern Norwegian and Swedish. There is also an English translation. From the middle of the 14th century the old skaldic poetry is succeeded by the so-called "rimur," a kind of ballad or epical paraphrases with themes from mythology and history. Almost every Icelandic saga or romance has been turned into such lays, and even the historical books of the Bible. The first of this kind is the 'Olafs-rima' (treating of Saint Olaf) by Einar Gilsson in the 14th century. The majority of these poems have as yet not been printed.

Even in the early heroic lays and in the skaldic poetry the Norwegians and the Icelanders had shown an interest in the history of their people. But the most adequate expression for this we find in the prose literature, of which the best productions are the famous *sagas*, a name applied both to history and fiction. The skald who composed the historical drápa and the writer of the saga had much in common, and the two were sometimes united in one person. The skald visited foreign countries and brought back with him, as did other travelers, the wealth of material for the prose tradition. From a more primitive beginning this tradition gradually developed, probably under the influence of the Irish saga developed in a similar way, into a well rounded and complete narrative of a certain fixed form, so that the writer who gave it its final shape in many cases only arranged the material for the purpose he had in mind. Another similarity with the Irish saga we find in the numerous quotations of skaldic verses to strengthen and confirm the reliability of the narrative. Most of the sagas treat of conditions on Iceland and of the history of the kings of Norway. In some sagas are found also remarkable experiences among other peoples with whom the Icelanders came in contact. It is especially in this historical field that the Norwegian-Icelandic literature reached its highest point and produced masterpieces that may both as to contents and form be called classical. The Icelandic sagas had their beginning about 1120 and continued down to the close of the 14th century. The first half of the 13th century may be considered the golden age of the sagas. Also in this literary production is seen a development into maturity, a growth and decay. But on the whole, the majority of the sagas show distinct characteristics of a very high value. The description in the so-called historical sagas is wholly impartial, and even in the few cases when we know who the author is he keeps entirely in the background. Often quotations from skalds and other authorities are found, the time of the happenings is carefully stated, and accurate descriptions of the historical places are given, the family connections, the personal appearance and the character of men and women are described in almost complete detail. Especially are the descriptions of character, although expressed in few words, admirable. The style of the saga shows its origin from oral tradition. It is simple and natural, without any long periods, and the frequent use of dialogue reminds one of the speech of every-day. The dramatic style in connection with the artistic arrangement of the subject gives the Icelandic saga a high rank in comparison with any other literature. The historical sagas treat of Iceland as a whole and embrace also the family sagas, whose trustworthiness is considered by modern scholars often very doubtful; the sagas of the kings of Norway; the sagas treating of other countries. Ari Frodi Thorgilsson (1067-1148) is the pioneer among historians. His 'Islendingabók' ('Book of the Icelanders') gives an account of the early settlement down to 1118. He also began the production of the 'Landnamabók' ('Landtaking Book') which was continued by several others, among them Sturla Thordsson. This unique work tells of the original settlers and their families and contains the names of 3,000 persons and 1,400 places. To the general history of Iceland belongs also 'Kristnisaga' on the introduction of Christianity, to which may be added several sagas of the bishops and collections of legends. 'Sturlungasaga,' the greater part of which was written by Sturla Thordsson, tells the history of the Icelandic republic down to 1284.

The family sagas discuss, with few exceptions, persons and events from the first settlement of the island to approximately 1030. Owing to the fact that in this period Iceland was occupied by the early settlers and that the new faith was introduced and to other causes, the many remarkable events furnished a wealth of material for the oral tradition to build on. These sagas are properly grouped according to the localities they describe. Of the large number only the most prominent may be mentioned. To the South belongs 'Njal's Saga,' the most celebrated and best of these sagas. In the West we find 'Egil's Saga,' also one of the best, telling us about the skald and warrior Egil Skallagrimsson. A continuation, in a way, of this saga is Gunnaug Ormstunga's Saga, short but very beautiful. Hoensa-Thori's Saga contains important contributions to the history of the Icelandic constitution. Eyrbyggia-Saga gives valuable information about customs and manners at the time the new land was occupied and tells about the heathen superstition. Laxdoela-Saga, remarkable for its excellent delineation of character and its vivid style. Gisle Sursson's Saga is a well told story of a man who was outlawed and gives information of the foster-brotherhood of the early days. 'Fostbroedrasaga' tells of Thorgeir Havarsson and Thormod Kolbrúnarskáld. To the North District belongs Kormak's Saga telling about his adventurous life and containing a number of love-songs. Hallfred's Saga tells about the fates of the above mentioned H. Vandrædaskald. Vatnsdoela Saga gives fine descriptions of persons and conditions at the time Christianity was introduced. Gretti's Saga contains many exaggerations and fables in telling about the outlaw Gretti the Strong. Viga-Glum's Saga is one of the oldest and best and throws much light on the culture of early times. In the North Hrafnkell's Saga gives much valuable information about the worship of the gods, the administration of law and political institutions. The history of Norway occupied the attention of Icelandic writers at an early date. Ari Frodi was the pioneer also in this field. Soon others followed his example, some writing a complete sketch of all of Norway's history, while others confined themselves to the history of one or several kings, especially Olaf Tryggvesson and Saint Olaf. For a short time the Latin language was used. The Norwegian monk Tjodrek wrote his 'Historia Norvegiæ' about 1179, and the Icelandic monks Odd and Gunnlaug wrote in Latin about Olaf Tryggvesson, but this work is now only preserved in an Icelandic translation. 'Ágrip af Noregs konungasogum' is the oldest history of Norway that has been preserved, written in the vernacular, briefly telling about the times from Halfdan the Swarthy to Sigurd the Crusader. Ágrip is written in Norwegian, but has been preserved in an Icelandic manuscript. Of Icelandic origin is 'Morkinskinna' ('Rottenskin'), a collection of sagas about Norwegian kings from 1035 to 1157, and 'Fagrskinna' ('Magnificent parchment'), a history of Norway from Halfdan the Swarthy to 1177. Among the skaldic poems found in this work is 'Eiriksmal' about King Erik Bloodyaxe. All the above mentioned historical works were preliminary to, and used as sources of, the greatest and most celebrated of historical works in all the old Scandinavian literature, Snorre Sturlason's 'Heimskringla.' It begins with the story of the royal family of the Ynglings, descended from the gods, and tells the history of Norway down to 1177. The saga of King Sverre (1177–1202) had already been written by one of his contemporaries, the Icelandic abbot Karl Jónsson. The so-called great saga of Saint Olaf is probably an elaboration of Snorre himself of the Olaf's saga in his Heimskringla. Continuations of Snorre's work are, besides the Sverre's saga, the saga about Sverre's three successors and the Saga of King Hakon Hakonsson, whose author was Sturla Thordsson. Of the saga of King Magnus Lagaböter (Law-mender) by the same author, we possess only a fragment. This was the last original Icelandic production on the history of Norway. From the close of the 13th century and through the 14th century there are a number of rather uncritical collections of historical sagas. Among these may be mentioned the 'Flateyarbók' (1370–80), containing not only sagas of Norwegian kings, but also sagas of the Orkneys and Faroes and other minor narratives. The sagas of Erik the Red and Thorfinn Karlsevne tell about the Norwegian discovery of Greenland and Vinland (America). Much information about the early history of Denmark is found in the 'Jomsvikinga Saga' and especially the 'Knytlinga Saga.' Contributions to the history of Sweden are found in several minor narratives, while Eymund's Saga gives information about Russia. Another class of sagas is the mythic-heroic ('Fornaldar-sögur'), in which the imagination of the writer has full play. A prominent place in this group has the Volsunga Saga, a narrative with many romantic embellishments, based on the heroic poems in the Elder Edda and others that have been lost. Connected with this saga is the Saga of Dietrich of Bern, compiled from German sources in Bergen, Norway, about 1250. The sagas of Hervor and Half and His Heroes contain many fragments of old poems. Hrolf Krake's Saga and Ragnar Lodbrok's Saga, especially valuable for the study of Danish traditions, give romantic descriptions of the viking age. The beautiful Fridthjof's Saga has furnished material for Tegner's famous poem. This with the saga of Orvar-Odd and others deals with Norway. It becomes difficult to draw the line between these heroic-mythic sagas and the folk-tales to which the transition was easy. To the latter belong the stories of Bard Snæfellsass, Gautrek, Sörle the Strong, and many others. As early as in the 13th century the taste for romances and romantic poems full of strange adventures and sentimental love-stories had spread to the North from foreign countries. We know that at the suggestion of the Norwegian king Hakon Hakonsson and his successors, stories of this kind were translated. There are more than 100 more or less free translations from Latin, English, German and especially French. Some of the translations made in Norway are by Icelanders.

As an example may be mentioned the long Karlamagnus Saga, a free prose translation of the French 'Chanson de geste.' Foreign influence is also seen in the legendary sagas. A few of these are of Norwegian origin, but most of them are translations. Best known is the saga of Barlaam and Joasaphat, translated by Hakon Sverreson, king of Norway. Also to be mentioned are Mariw saga, 'Postola sögur, Helgra manna sögur.' 'Stjórn' (produced in Norway) retells in a free manner the historical books of the Old Testament and has some additions from Josephus and other sources. 'Grágás' is the name of the code of laws for the Icelandic republic. It is based on the laws brought from Norway by Ulfljot and adopted by the first Althing in 928. The manuscripts are from the 13th century. After the union with Norway a new law was adopted, called 'Hákonarbók' after King Hakon or 'Jarnsida' (Ironside) from its cover. In 1281, during the reign of Magnus Lawmender, the 'Jónsbók' was adopted. To scientific works belongs the Younger Edda or Snorre's Edda which gives rules for the skalds, a guidance for young poets. From the beginning of the 15th century, the darkest age of Icelandic history, there is stagnation in the literary activity. From this time the Norrön literature, common to Iceland and the mother county, ceases, even in Iceland, while it had ceased in Norway the century before, and as far as the language is concerned, the two countries part company. The terrible Black Death (1402–04), famine and other plagues devastated the country. It almost killed all spiritual life. The old literature seemed for a long time to be forgotten, copyists and annalists ceased their work (1430). There seemed to be no inspiration for either a national or religious revival. The only things of literary interest from this age are the weird folktales, orally transplanted to later generations and increased by them and published only in recent years, while the love of poetry which never became quite extinct found an outlet in the so-called rimur.

Modern Period.— Printing was introduced in 1530 by the last Catholic bishop, Jon Arason. He was a lyric poet of note. The first, not very good, translation of the New Testament was made by Oddur Gottskalksson, printed in Denmark in 1540. Bishop Gudbrandur Thorlaksson completed in 1584 his fine translation of Luther's German version of the whole Bible. On this translation as on a foundation was created the modern Icelandic literature. From his printing establishment at Holar no less than 85 works were issued between 1574 and 1624. The new literary interest created by the Reformation had an almost exclusively religious character down to 1720. Jon Thorkelsson Vidalin (1666–1720) ranks with the very best preachers of the Scandinavian countries, and his family book of sermons was found in almost every home. In this period Iceland had a large number of writers of hymns. Religious poetry reached its highest in the popular productions of Hallgrimur Petursson (1614–1674). In the Age of Learning, Arngrimur Jonsson Vidalin and Brynjolfur Sveinsson, who discovered the manuscript of the Elder Edda, were excellent Latin scholars and published works in Latin. Vidalin published 'Crymogæa' ('Iceland'), the first comprehensive description of Iceland's nature, people, language and history. Through his correspondence with the Danish scholar Oluf Worm and others a beginning was made in the modern scientific study of Scandinavian antiquities and languages. Even among the Icelandic peasants (Björn Jonsson, Jon Gissursson) is found this awakened interest. Some begin to write "annals," others revive the old custom of copying. The first Icelandic dictionary was written by Magnus Olafsson and published by Worm (1650). The Magnænum'). In Latin wrote Finnur Jonsson Pall Jonsson Vidalin published a learned work on the laws. Of the greatest importance are the works of the historian Torfæus (1636–1719) and the famous Arni Magnusson (1663–1730) who brought his great collection of manuscripts to Copenhagen. A large number of poets produced thousands of rimur or epic poems. Gudmundur Bergthorsson (1655–1705) produced 252 rimur and enjoyed a great reputation. Also a large number of lyric poems were produced. In the beginning of the 18th century Iceland suffered greatly under various misfortunes, especially smallpox, which reduced the population to 32,000.

The language at this time shows Danish influence, especially in business and law. Eggert Olafsson who writes on economic and other subjects, is the first to again revive the national spirit. He was also a poet. Economic works are published in this Age of Enlightenment. The first periodical makes its appearance in Danish. The study of history and literature was revived. Many works were published, often in Danish and printed in Denmark; Icelandic scholars were important contributors as Jon Olafsson, Jon Erichsson, Grimur Jonsson Thorkelin ('Diplomatarium Arna-Magnænum') In Latin wrote Finnur Jonsson the ecclesiastical history of Iceland, Halfdan Einarsson his literary history. The first valuable dictionary was by Björn Halldorsson. It was published by Rasmus Rask in 1814. The first Icelandic periodical was started in 1796. The 19th century is in Iceland as in other countries characterized by a strong, conscious national awakening. It had in its beginning a literary, later also a political, character, which is leading to new political relations with Denmark, if not to complete separation and the establishment of the Icelandic nation. In 1816 the great Danish scholar Rask established with his friends, the Icelandic scholars Sveinbjörn Egilsson, Arni Helgason, Bjarni Thorsteinsson, Finnur Magnusson "Hid islenzka Bokmentafelag." The aim of this literary society was to work for the purification of the language and the education of the people. Under very able leaders, especially Jon Sigurdsson (1851–79), the great leader of modern Iceland, this society which is still flourishing has done great services for the development of Iceland in almost all fields, through the publication of old Icelandic works, studies in language and literature, the two periodicals *Timarit* and *Skirnir*. But most of the scholarly contributions to old Icelandic history, literature and philology have been made by these and other great Icelandic scholars independently. Here we have such prominent names as Finnur Magnusson, Sveinbjörn Egilsson, Jon Sigurdsson, Gudbrandur Vigfusson, Eirikr Jonsson, Jon Thorkelsson, Benedikt Gröndal, Gisli Brynjulfsson, and in most recent time Finnur Jónsson, professor in Copenhagen, Björn M. Olsen, president of Iceland's University at Reykjavik (1911), Valtyr Gudmundsson. The special history of Iceland has been treated in a number of books. The periodical literature has played an important part. *Eimreidin* is at present the best known periodical. Modern Iceland has produced a number of lyric poets. Some of these have also excelled in other fields. Jon Thorkelsson's novels ‹Piltur og stulka› and ‹Madur og kona› have been translated into English. There are many good translations from the literature of the Scandinavian and other countries. In most recent time the drama has an excellent representative in Johann Sigurjonsson, also known to English readers.

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ICENI, ī-cē'nī, a tribe which inhabited ancient Britain, occupying the territory now called Norfolk and Suffolk. When Aulus Plautius engaged in battle against the sons of Cymbeline, the Iceni assisted him. However, they resisted the further aggressions of the Romans, and under their Queen Boadicea fought against them. Roman arms were victorious and the Iceni were forced to retire. Consult Oman, ‹History of England› (New York 1910).

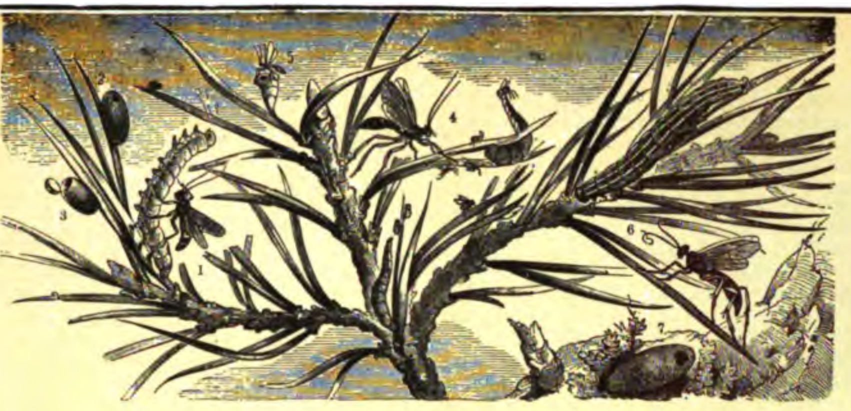
ICH DIEN, ĭн dēn (Ger. *I serve*), the motto of the Prince of Wales, written on his official crest surmounted by three ostrich plumes. The Welsh derive it from *Eich dyn*, meaning «Behold your man,» and tell the story that the expression was first used by Edward I in presenting his new born son to his people. Another current version of the origin of the phrase is that the Black Prince found the motto inscribed under the plume of John, king of Bohemia, who was killed at Crécy. Historians give preference to the former interpretation.

ICHANG, ē'chăng, China, a city in the Province of Hupeh, on the left bank of the Yang-tse River, from which position it derives its great commercial importance. The chief agricultural products are rice, cotton, wheat, barley, wood-oil and fruits. In 1877 Ichang became an open port for European trade. Because of its proximity to the Yang-tse Gorges which are impassable, all downstream traffic must be transshipped. Light vessels can proceed to Ichang proper in an upstream course, and there are certain ships designed especially to accommodate the navigation facilities of the Yang-tse. There is a railway route from Ichang to Kweichow. Pop. (1916) 55,000; total foreign imports, 1,429,897 haikwan taels (1 haikwan tael=about $.75); native imports, 1,685,492 haikwan taels; and total exports, 3,514,662 haikwan taels.

ICHIDO, ē'chē'dō, the private name of Hitotsubashi, leader of the anti-foreign party in Japan and the «last of the Tycoons.» See Hitotsubashi.

ICHNEUMON-FLY, ĭk-nū'mŏn, the name of a large family (*Ichneumonidæ*) of insects of the order *Hymenoptera*. As the species of this family are very numerous (more than 1,100 genera have been described) so their manners are extremely diversified; but, in the general outlines of their character, they all agree, particularly in their depredations among the insect tribes. In some the female has the ovipositor in the form of a boring instrument, with which she is capable of perforating the hardest wood. The larvæ of wasps are the devoted prey of these insects, who no sooner discover one of their nests than they perforate the material of which it is constructed, and deposit their eggs within it. Others glue their ova to the skin of a caterpillar, while others again penetrate through it and lay their eggs in its body. In all these cases the young, as soon as they are hatched, prey on the caterpillar or larva, without, however, destroying it at once, as upon the life of its victim that of the spoiler appears to depend. The caterpillar, in fact, seems healthy until the larvæ of the ichneumon have bored through its skin, have spun their cocoons on its surface and entered the chrysalis state. These carnivorous insects are of various sizes; some are so small that the aphis, or plant-louse, serves as a cradle for their young; others again, from their size and strength, are formidable even to spiders, destroying them with their stings. They are, as a whole, highly beneficial to humanity, as a large part of their prey consists of insects which are injurious to crops and valuable vegetation. Consult Howard, ‹The Insect Book› (New York 1901).

ICHNEUMONS, ĭk-nū'mŏnz, small carnivorous animals of the civet family (*Viverridæ*) and sub-family *Herpestinæ*, which are distinguished from the true civets by the straight non-retractile claws, and various skeletal characters. While there are a number of genera the typical and most important is *Herpestes*, many species of which inhabit Africa, southern



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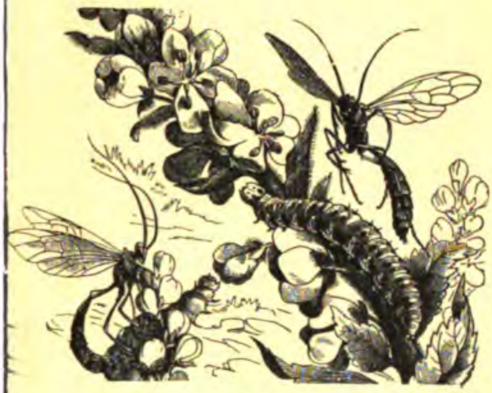

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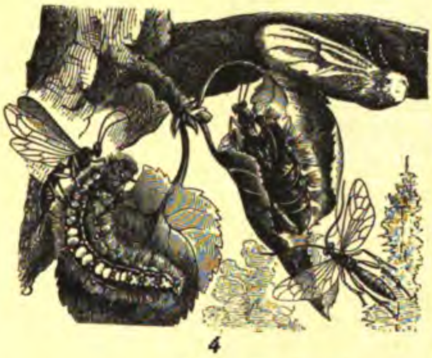

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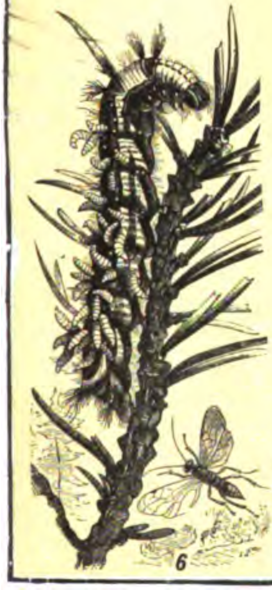

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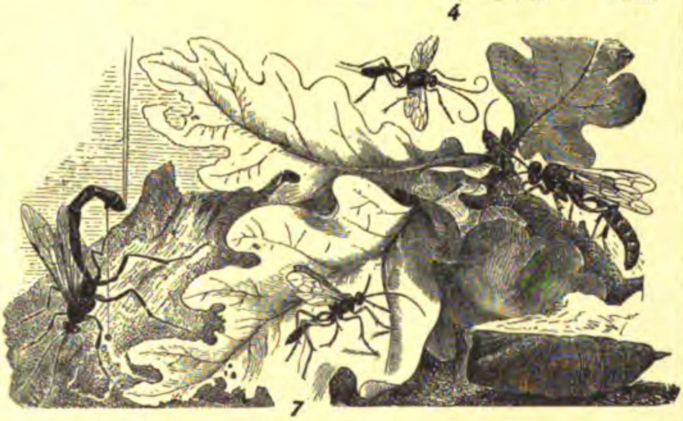

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1 (1) Exenterus marginatorus attacking the larva of the pine-tree moth; (2) the cocoon of the latter as left by an ichneumon-fly; (3) as left by its rightful occupant; (4) Bassus albosignatus attacking the larva of the syrphus-fly; (5) male of the same; (6) Banchus falcator stealing upon a caterpillar; (7) larva of the ichneumon-fly

2 Anomalon circumflexum attacking a caterpillar; and Ophion undulatus thrusting its ovipositor into the body of a caterpillar

3 Spathius clavatus, in a window

4 Pimpla instigator, preying upon a willow-moth

5 Pupa-case of an Ophion

6 Larva of Microgaster nemorum emerging from an infested caterpillar of the pine-tree moth

7 Ichneumon pisorius, the left-hand figure being that of a female depositing eggs in a boring in the trunk of an oa

Asia, and the neighboring islands. The teeth are numerous, usually 40; the head is elongated, with short rounded ears; the limbs are short; and the body and stout tail are covered with long hairs. They vary in size from that of a squirrel to a cat. Their food consists of all kinds of small animals; rats and mice, birds and their eggs, snakes, lizards, etc., which they pursue chiefly on the ground but also in trees. The Egyptian ichneumon (*H. ichneumon*) or Pharoah's rat (or mouse) is famous as one of the many animals venerated by the ancient people of that country, because, it has been said, of its reputation as a destroyer of crocodile's eggs. While the eggs of this reptile may be occasionally devoured, the importance of the ichneumon in this respect is purely mythical; and it was protected, more likely, as a killer of the asp and other venomous serpents. Even now it is kept by many rural households there, as a hunter of rats, snakes and other vermin. The Indian ichneumon or mungoose (*H. mungoos*) is still better known. It lives in a semi-domesticated state, and performs an invaluable service as a destroyer of venomous serpents, whose fangs it generally manages to escape by its wonderful agility. This species has been introduced into Jamaica for the purpose of destroying rats, and has multiplied exceedingly and become a serious pest, though of late years it has been held in check by a great increase in the number of ticks. See MUNGOOS.

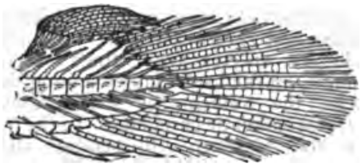
ICHNOLOGY, ĭk-nol'ō-jĭ, that department of palæontology which treats of the foot-prints petrified in sedimentary rocks and made by extinct animals; the science of fossil foot-prints. Such foot-prints frequently occur in all formations, and have sometimes been the first and most instructive intimation of the existence of the animals that made them. This was particularly true of the foot-prints of dinosaurs (q.v.) so numerous and sharply marked in the brown sandstones of the Connecticut Valley; and they have greatly assisted in arriving at a true realization of those reptiles, which were at first regarded as birds. The tracks, trails, burrows, outlines of bodies, feathers and appendages of a vast variety of animals occur in the rocks and interest the ichnologist.

ICHTHYOL, a medicinal substance occurring as ammonium and sodium ichthyol sulphonate, the two most important salts of ichthyolsulphonic acid, which is prepared from a bituminous mineral of the Tirol, which contains large amounts of fossilized remains of fish and other sea animals. Ichthyol was first introduced into medicine by Unna of Hamburg, and has proved very valuable when applied externally in certain diseases of the skin, acne, erysipelas, acute articular rheumatism, etc., and for the purpose of removing pain and induration about the inflamed joints. The ammonium salt is liquid, but the sodium salt is solid, and the latter is therefore most frequently employed when the drug is given internally for the purpose of affecting the alimentary canal or the general system.

ICHTHYOLOGY, ĭk'thĕ-ŏl'ō'jĭ (Gr. ἰχθύς fish; λογός, a discourse), is the science of fishes. It is that branch of human knowledge which treats of the aquatic gill-bearing vertebrates, popularly known as fishes to English-speaking people.

Classification of Fishes.— In different treatises on fishes there appear very great differences in the classification proposed or adopted. Often in two works of parallel scope scarcely a group will appear in both with the same boundaries or under the same name. For this condition there are several causes. First, the tendency in some minds toward the extreme of subdivision, and in others toward the extreme of aggregation; second, the various values assigned by different authors to different sorts of characters, the actual value of each only to be determined by the final judgment of palæontology; third, the tendency of many writers to give new names to old groups. On this account a single class order may have half a dozen virtually synonymous names. Thus the terms *Chondropterygii, Elasmobranchii, Plagiostomi, Selachii, Placodii, Antacea,* and other less known names have been applied to the group of sharks and skates. Again various authors, recognizing the validity of a given group, may find it necessary at times to change its boundaries. In such a case a new name may be proposed, or a new definition be given to an old one. Either arrangement may lead to confusion. Thus with some writers, the groups of sharks, under various names may include the order of *Chimæroids,* or, under the same names, the *Chimæroids* may be excluded from it.

The Chordata.— The great branch of chordate animals finds its origin perhaps in extinct wormlike types or possibly in marine creatures remotely allied to the horse-shoe crab and to spiders. Common opinion favors the first hypothesis. It differs essentially from the invertebrate branches in the presence of a more or less developed notochord (which in the higher forms gives place to a backbone), and in the presence of gill-slits, connected with respiration. These gill-slits and accompanying gill-structures are persistent in fishes, while in higher vertebrates they are mostly relegated to the embryonic stages.



A Diphy-cercal Tail.

The *Chordata* include several classes of marine animals leading up to the true fishes, as follows:

Entropneusta.— Balanoglossus (q.v.).

Tunicala.— Ascidians (q.v.).

Leptocardii.— Lancelets (q.v.).

Cyclostomi.— Hag-fishes and Lampreys (qq.v.).

Cycliæ.—An extinct (*Palæospoudylus*) fish-like form.

Pisces.— Fishes, properly so-called; the various primary divisions of which *Elasmobranchii, Ostracophori* (*Ostracodermi*), *Arthrodira* and *Teleostomi* are usually called subclasses.

But in view of the uncertainty attached to the mutual relations and origin of these groups, we may follow recent American custom in regarding the elasmobranchs, ostracophores, arthrodires and teleostomes as distinct classes, the last named group containing the typical or true fishes. On anatomical grounds we must regard the *Elasmobranchii* (sharks) as the most primitive of these classes. As to this, palæontology gives no certain answer but the tendency of evidence is rather toward regarding the ostracophores as still more primitive. There is no doubt that fishes existed and that some of the classes were well differentiated at a period long antecedent to the deposition of the oldest known remains. The earliest remains of fossil fishes now known occur in the Ordovician or Lower Silurian deposits at Cañon City, Colorado. Among the broken fragments are apparently parts of shields of ostracophores, scales of crocsopterygians and vertebræ of a possible chimæroid. It is probable that primitive sharks existed still earlier than this, but no definable remains precede the Devonian.

The class or sub-class of *Elasmobranchii* (also called *Chondropterygii*, *Antacea*, etc.) agrees with the higher fishes in the presence of lower jaw, shoulder-girdle, pelvic girdle, paired fins, well developed skull, brain and viscera. The gills are well developed, and the general structure and anatomy may be described as fishlike.

In distinction from the true fishes, the gills are differently formed, adnate by their outer margin, there are no membrane bones about the head, the ova are very large, the ventral fins are provided with claspers, there is no trace of air-bladder, the arterial bulb has three series of valves, there is a spiral valve in the rectum, the upper jaw is formed of palatal elements, the typical jawbones of the fish being undeveloped. The lower jaw is also different in structure from that of the true fishes.

The existing elasmobranchs are known as sharks, rays and chimæras. The vast majority of the known species are extinct. There are two strongly marked sub-classes among the elasmobranchs, the *Selachii* or sharks and rays, and the *Holocephali* or chimæras. In the *Selachii* there are five to seven gill-openings, the jaws are distinct from the skull, and the teeth are distinct. In the *Holocephali* there is but one external gill-opening, the jaws are coalescent with the skull, and the teeth are united to form bony plates or lamellæ. Both groups are very old in geologic times, having been separated at least since the Devonian. For this and other reasons some writers prefer to regard the sharks and chimæras as separate and co-ordinate groups or classes.

A Lancelet (*Branchoistoma*).

We may without serious violence divide the sharks and rays into six orders; namely, *Pleuropterygii*, *Acanthodii*, *Ichthyotomi*, *Notidani*, *Asterospondyli*, and *Tectospondyli*, the first three of these being confined to Palæozoic time. We may regard the *Pleuropterygii* or the allies of *Cladoselache* as the most primitive, and therefore as standing first in an ascending series.

In this group the pectoral and ventral fins are broad and fold-like, the notochord is apparently not segmented, the tail is short and keeled, well specialized, its tip abruptly turned upward. There are no spines, the teeth are small, with many cusps. There is probably but one family, the *Cladoselachidæ* (extinct), *Cladoselache fyleri*, a large elongate shark from the Devonian of Ohio, is the best known species.

The *Acanthodii* are small sharks with a spine at the front of each fin except the caudal. The teeth are minute or wanting, and the skin is covered with small checker-like plates. There are three families, *Acanthoëssidæ* (extinct), with one dorsal fin, *Diplacanthidæ* (extinct), with two, and the *Ischnacanthidæ* (extinct), small sharks found from the Devonian to the Permian.

The *Ichthyotomi* have the pectoral fin developed as an archipterygium or jointed limb with a fringe of rays on one or both sides. The dorsal fin extends along the back, and on the head is a first dorsal preceded by a long spine. There are two well-marked families, *Pleuracanthidæ* and *Cladodontidæ*, abundant in the Carboniferous and Permian, but now extinct.

The *Notidani* or *Diplospondyli* have the notochord imperfectly segmented by vertical partitions, and the gill-clefts are six or seven in number instead of five, as in other sharks. Most of the species are extinct, the teeth being found in the rocks from the Jurassic to the present time. Two families are represented, the *Hexanchidæ* and the *Chlamydoselachidæ*, the latter ell-shaped sharks of the open sea, chiefly about Japan.

In the large order of *Asterospondyli* the vertebræ are strengthened by secondary plates of calcified tissue, which radiate outward from the small primitive cylinder. In these typical sharks there are five gill-slits, two dorsal fins and one anal fin.

In the most primitive group, the sub-order *Cestraciontes*, the dorsal fins are each armed with a spine, the numerous teeth are small and mostly blunt, differing in form in different parts of the jaw, and the vertebræ are imperfectly formed. A curious fact in geological distribution is that a multitude of early types of shark disappear in the Permian or toward the end of Palæozoic time. Only cestraciont sharks are known to have any representatives in the Triassic, and this group may be ancestral to all modern sharks.

Of the *Cestraciontes* the Palæozoic families of *Cochliodontidæ* (extinct) and *Orodontidæ* (extinct), known mainly by the teeth, occur in the Lower Carboniferous. In some and probably all of these forms the dorsal fins were each armed with a spine. The *Edestidæ* (extinct), known only from coiled whorls of fused teeth, are doubtless closely related to these forms. These are found in the coal measures. The principal living family of *Cestraciontes*, the *Heterodontidæ*, begins in the Permian, and is represented by five living species all in the

Pacific Ocean, the longest known being the Port Jackson shark of Australia (*Heterodontus philippi*). We may here mention two families of sharks of uncertain relationship, the species confined to the Carboniferous Age. These are the *Petalodontidæ* (extinct), with blunt teeth and some of them with broad fins like rays, and the *Psammodontidæ* (extinct), known from the blunt teeth only. Still more uncertain is the group of *Tamiobatidæ* (extinct) from the Devonian of Kentucky, resembling a ray, but probably a primitive offshoot from the sharks.

The remaining asterospondylous sharks form a sub-order, *Galei,* without dorsal spines, and with the vertebræ more perfectly calcified. The principal family is the *Galeorhinidæ*. Others are the *Sphyrnidæ* or hammer-heads, *Scylliorhinidæ* or cat-sharks, *Ginglymostomidæ, Hemiscylliidæ, Orectolobidæ, Lamnidæ* or man-eater sharks, *Odontaspidiæ,* or sand-sharks, *Alopiidæ,* or thresher-sharks, *Mitsukurinidæ* or spoon-bill sharks, *Cetorhinidæ* or basking-sharks, *Pseudotriakidæ* and *Rhineodontidæ.* Of the *Lamnidæ* and related families fossil teeth (*Carcharodon, Isurus, Lamna*) are very numerous from the Jurassic to modern times.

The *Tectospondyli* have the vertebræ each provided with secondary plates of calcified tissue concentrically arranged in one or more series. In these sharks there is no anal fin. To these belong the *Squalidæ* or dog-fishes, *Dalatiidæ, Oxynotidæ* and *Echinorhinidæ* or bramble-sharks, these families forming together the sub-order *Cyclospondyli,* having the vertebral centrum a simple constricted cylinder pierced by the notochord. To the *Tectospondyli* proper we may refer a few families of sharks, the *Squatinidæ* (*Rhinidæ*) or monk-fishes, and *Pristiophoridæ* or saw-sharks. A third sub-order, *Batoidei,* includes all the skates or rays. These agree with the true *Tectospondyli* in having a number of series of concentric plates within the vertebræ. The body is, however, more or less depressed, the broad pectoral fins outlining a body disk, and the gill-openings lie underneath instead of being lateral, as in all the sharks. The rays are first certainly known from the Jurassic, although several of the Carboniferous shark have ray-like teeth, and have been referred to the group of rays.

The recognized families of rays are the *Pristididæ* or saw-fishes, the *Rhinobatidæ* or guitar-fishes, the *Narcobatidæ* or torpedos, the *Rajidæ* or skates, the *Dasyatidæ* or sting-rays, the *Myliobatidæ* or eagle-rays, the *Mobulidæ* or devil-fishes, and the *Ptychodontidæ* (extinct) of the Cretaceous. The earliest of these groups, the *Rhinobatidæ,* date from the Jurassic.

In the sub-class of *Holocephali* or *Chimæroids* the upper jaw or pterygoquadrate arcade is immovably joined to the skull. The teeth are coalesced into broad plates, and a fold of skin covers the gill-clefts so that there is but one external opening. The vertebral axis is imperfectly segmented, and the notochord is surrounded by partially calcified rings. In all recent genera, and in most others, there is a strong spine in the first dorsal, and in the male the forehead has a singular cartilaginous hook with a brush of spines at the end.

There are fragments referred to the skeleton of a chimæroid found in the Lower Silurian at Cañon City, Col. Numerous forms appear in the Devonian. Four genera, representing three families, are now extant, the *Rhinochimæridæ* (*Rhinochimæra* and *Hariotta*) in the deep seas, *Chimæridæ* or elephant-fishes (*Chimæra*) in the north and south temperate seas, and *Callorhynchidæ* (*Callorhynchus*) in the seas of the southern hemisphere only. Extinct families are the *Ptychodontidæ* (extinct), the *Squaloraiidæ* (extinct), and the *Myriacanthidæ* (extinct). Numerous extinct genera are referred to the *Chimæridæ.* Fossil fin-spines of many species of sharks and chimæroids, fishes otherwise unknown, occur in the rocks. These are called ichthyodoroulites, and their proper classification is often a matter of much uncertainty. The earliest of these are known as *Onchus,* occurring in the Upper Silurian.

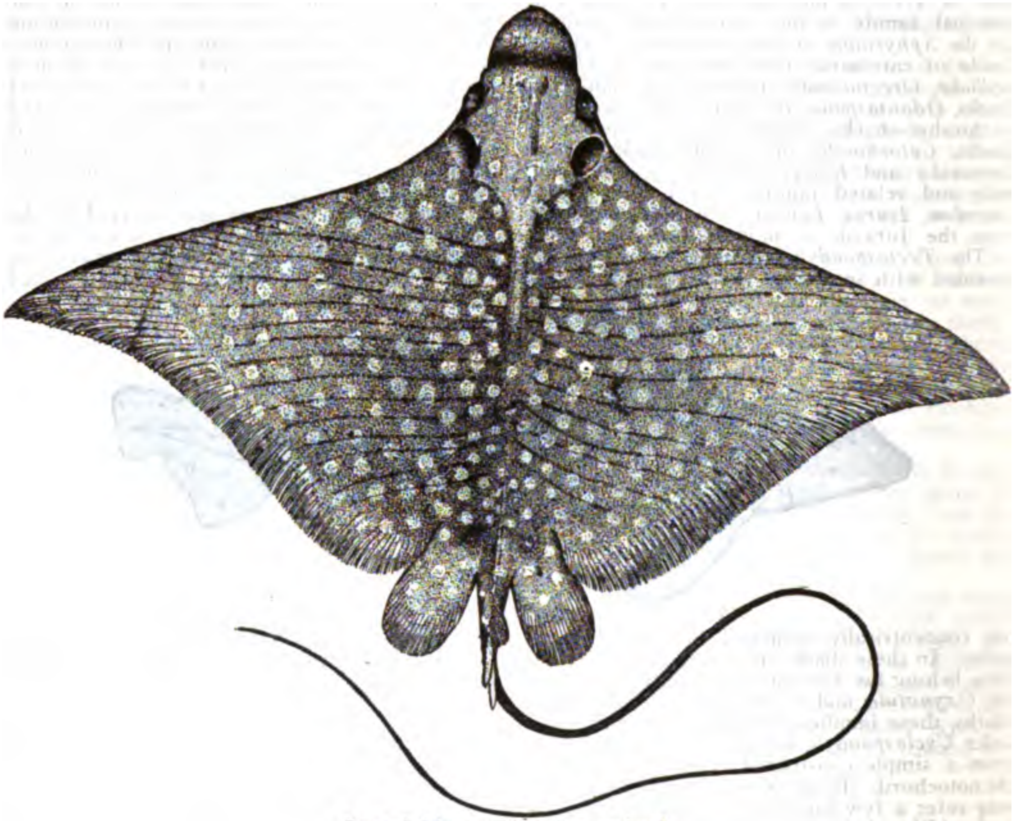
Bullhead Shark of California (*Gyropleurodus francisci*).

Class Ostracophori.—The earliest vertebrates actually recognized as fossils are known as ostracophores (’ *ὄστρακον* , a box: *φορέω*, to bear). These are most extraordinary creatures, which may be described as jawless, limbless, enveloped in a coat of mail. While they have been called mailed lampreys, the likeness to lampreys is almost wholly negative, resting in the total absence of jaws, limbs and limb-girdles. What the mouth was like can only be guessed, but no trace of jaws has yet been found in connection with it. The most remarkable distinctive character is found in the presence of a hard shell, made of bony plates covering the anterior part of the body, while the backbone is developed as a persistent notochord, imperfectly segmented. The entire absence of jaw structures, as well as the character of the armature, at once separates them widely from the mailed arthrodires of a later period.

This group was originally called *Ostracodermi,* a name preoccupied for the group of bony trunk-fishes (*Ostraciidæ*). The names *Protocephali* and *Aspidoganoidei* have also been used for them. The still earlier name *Placodermi* included the *Arthrodires* as well.

It may be that they are really allied to certain early crustacean-like forms which they resemble.

The ostracophores are found in the Ordovician, Silurian and Devonian rocks, after which they disappear. The species are very numerous and varied. Their real affinities have been much disputed. Traquair regards them as much modified allies of ancient sharks, which view of the case is supported by features in the structure of the most shark-like of the orders, *Anaspida*. The absence of jaws and limbs separates them widely from true fishes, and there is no clear evidence in the structure of the fins and fin-supports that these structures are homologous with the fins and fin-supports of true fishes, or even of sharks. In this group are four well-marked orders, *Heterostraci, Anaspida, Aspidocephali* and *Antiarcha*.



Spotted Sting-ray. (*Aetobatus narinari*).

The *Heterostraci* (ἕτερος, different; ὄστρακον, box) have no bone-corpuscles in the coat of mail. This order includes the *Pteraspidæ* (extinct), *Thelodontidæ* (extinct), *Drepanaspidæ* (extinct) and *Psammosteidæ* (extinct).

The *Anaspida* are more fish-like in appearance, having the armature of the head not plate-like, but formed of tubercles. There are two families, all of recent discovery, *Birkeniidæ* (extinct) and *Euphaneropidæ* (extinct).

The *Aspidocephali* (also called Osteostraci) have bone-corpuscles in the shields, and the shield of the back is of one piece, without lateral line-channels or sense-organs. The order includes four families, *Ateleaspidæ* (extinct), *Cephalaspidæ* (extinct), *Thyestidæ* (extinct), and *Odontodontidæ* (*Trematospidæ*) (extinct), with many genera and species.

The *Antiarcha* have also bone-corpuscles in the plates, which are also enameled. The sense-organs occupy open grooves, and the dorsal and ventral shields are of many pieces. The head is jointed on the trunk, and jointed to the head are paddle-like appendages covered with bony plates and resembling limbs. There is no evidence that these erectile plates are real limbs. They seem to be rather jointed appendages of the head-plate, erectile on a hinge like a pectoral spine.

There is but one family, *Asterolepidæ* (extinct). *Pterichthyodes milleri*, named by Agassiz for Hugh Miller, from the Lower Devonian, is the best-known species.

Class Arthrodires.—Another group of extinct mailed fishes is known as *Arthrodira* (ἄρθρον, joint; δειρή, neck). In this group jaws are developed, but of peculiar character, the mandibles being regarded as mere dermal elements, not forming part of the skeleton. The head in all the species is covered with a great bony helmet. Behind this on the nape is another large shield, and between the two is typically a hinge-joint, which has been compared to the hinge of a spring-beetle (elater). Some of these plates are traversed by sensory grooves. Nothing whatever is known of the internal structure, and as the skeleton is soft, the backbone notochordal, there is no trace of shoulder-girdle, nor any certain evidence of limbs, although peculiar structures have been interpreted as such. The presence of a peculiar type of jaws separates the group from the mailed ostracophores, from which the arthrodires differ also widely in the character of the armature.

Dr. Woodward and several other recent writers have regarded the arthrodires as armored, widely modified offshoots of the primitive *Dipneusta*. But the evidence does not seem to justify the union of the arthrodires with the latter group, and it would seem as reasonable to regard them as derived directly from the sharks or the ostracophores. The arthrodiran fishes occur in abundance from the Silurian times to the Mesozoic. In the Devonian their gigantic size and thick armor gave them the leading position among the hosts of the sea, ranging in size «from that of the perch to that of the basking-shark.»

The class, called by Dr. Dean *Arthrognathi*, is divided by him into two sub-classes, *Arthrodira*, with a hinge at the neck, and *Anarthrodira*, without hinge. In the first of typical sub-class are two orders, *Temnothoracici*, with the single family *Chelonichthyidæ* (extinct), *Anthrothoraci*, with the families *Coccosteidæ*, *Dinichthyidæ* (extinct), *Titanichthyidæ* (extinct), *Mylostomidæ*, and *Selenosteidæ* (extinct). To the *Chelonichthyidæ* belongs the noted species *Homosteus* or *Pterichthyodes milleri*, celebrated by Hugh Miller under the name of «the Asterolepis of Stromness,» in his 'Footprints of the Creator.'

The arthrodires without joint at the neck constitute the order *Stegothalami*, with the families of *Macropetalichthyidæ* (extinct), and *Asterosteidæ* (extinct).

The best known of the many genera of arthrodires is *Coccosteus*, found in the Scottish Devonian.

Class Teleostomi.— We may unite the remaining groups of fishes under a single class for which the name *Teleostomi* (τέλεος, true; στόμα, mouth), proposed by Bonaparte in 1838, may be retained. The fishes of this class are characterized by the presence of a suspensorium to the mandible, by the existence of membrane-bones (opercles, suborbital, etc.) on the head, by a single gill-opening, leading to gill-arches bearing bilamellate gills, and by the absence of claspers on the ventral fins. The skeleton is more or less ossified in all the *Teleostomi*. More important as a primary character distinguishing these fishes from the sharks is the presence typically and primitively of the air-bladder. This arises at first as a diverticulum from the ventral side of the œsophagus, and develops as a lung, but in later forms it becomes degraded to a swim-bladder, springing from the dorsal side of the alimentary canal, and in very many forms it is altogether lost with age. The group comprises the vast majority of recent fishes, as well as a large percentage of those known only as fossils. In these, the condition of the lung can be only guessed.

The *Teleostomi* are doubtless derived from sharks, their relationship being perhaps nearest to the *Ichthyotomi* or to the primitive chimæras. The lowest *Teleostomi* retain the shark-like condition of the upper jaw, made of palatal elements which, as in the *Chimæra*, may be fused with the cranium. In the lower forms also the primitive diphycercal or protocercal form of tail is retained, as also the archipterygium or jointed axis of the paired fins, fringed with rays on one or both sides.

We may divide the teleostomes or true fishes into three sub-classes, the *Crossopterygii* or fringe-fins, the *Dipneusti* or lung-fishes, and the *Actinopterygii* or ray-fins. Of these, recent writers are disposed to consider the *Crossopterygii* as most primitive, and to derive from this, by separate lines, each of the remaining sub-classes, as well as the higher vertebrates.

Sub-class Crossopterygii.— The earliest teleostomes constitute the class called after Huxley, *Crossopterygii* (κροσσός, fringe; πτερόν, fin). Its essential character is the retention of the jointed pectoral fin or archipterygium, its axis fringed by series of soft rays. This character it shares with the *Ichthyotomi* among sharks, and with the *Dipneusti*. From the latter it differs in the hyostylic cranium, the lower jaw being suspended from the hyomandibular — and by the presence of distinct premaxillary and maxillary elements in the upper jaw. In these characters it agrees with the ordinary fishes. The skeleton is more or less perfectly ossified. Outside the cartilaginous skull is a bony coat of mail. The skin is covered with firm scales or bony plates. The tail is diphycercal, straight, and ending in a point. The shoulder-girdle, attached to the cranium, is cartilaginous, but overlaid with long, bony plates, and the branchiostegals are represented by a pair of gular plates.

In the single family (*Polypteridæ*) represented among living fishes the heart has a muscular arterial bulb with many series of valves on its inner edge, and the large air-bladder is divided into two lobes, having the functions of a lung, though not cellular as in the lung-fishes.

The fossil types are very closely allied to the lung-fishes, and the two groups have no doubt a common origin in Silurian times. It is now usually considered that the crossopterygian is more primitive than the lung-fish, though at the same time more nearly related to the ganoids, and through them to the ordinary fishes.

From the primitive *Crossopterygii* the step to the ancestral amphibia, which are likewise mailed and semi-aquatic, seems a very short one. It is true that most writers until recently have regarded such dipneustans as the *Ceratodontidæ* as representing the parents of the amphibians. But the weight of recent authority, Gill, Boulenger, Dollo and others, seems to place the point of separation of the higher vertebrates with the crossopterygians.

Cope and Woodward divide the *Crossopterygii* into four orders or sub-orders, *Haplistia*, *Rhipidistia*, *Actinistia* and *Cladistia*. To the last belong the existing species (*Polypterus*) alone. In all these the pectorals are narrow with a single basal bone, and the nostrils, as in the dipneustans, are below the snout.

In the *Haplistia* the notochord is persistent, and the basal bones of dorsal and anal fins are in regular series, much fewer in number than the fin-rays. The single family *Tarrassiidæ*, regarded as lowest of the crossopterygians, are small fishes of Carboniferous Age.

In the *Rhipidistia* the basal bones of the median fins are found in a single piece, not seprate as in the *Haplistia*. Four families are recognized, *Holoptychiidæ* (extinct), *Rhizodontidæ* (extinct,) *Osteolepidæ* (extinct), *Onycho-*

dontidæ (extinct), the first of these being considered as the nearest approach of the crossopterygians to the dipnoans.

In the *Actinistia* there is a single fin-ray to each basal bone, the axonosts of each ray fused in a single piece. The notochord is persistent, causing the backbone in fossils to appear hollow, the cartilaginous material leaving no trace in the rocks. The genera and species are numerous, ranging from the Subcarboniferous to the Upper Cretaceous, and belonging to the single family *Cœlacanthidæ* (extinct).

In the *Cladistia* the axis of the pectoral limb is fan-shaped, made of two diversified bones joined by cartilage. The notochord is restricted and replaced by ossified vertebræ. The axonosts of the dorsal and anal are in regular series, each bearing a fin-ray. The order contains the single family *Polypteridæ,* represented by numerous species in the Nile, Senegal and Kongo rivers. In this group the pectoral fin is formed differently from that of the other crossopterygians, being broad, its base of two diverging bones with cartilage between. This structure, more specialized than in any other of the crossopterygians or dipneustans, has been regarded by Gill and others, as above stated, as the origin of the fingered hand (chiropterygium) of the frogs and higher vertebrates. The base of the diverging bones has been identified as the antecedent of the humerus, the bones themselves as radius and ulna, while the intervening, non-ossified cartilage breaks up into carpal bones, from which metacarpals and digits ultimately diverge. This hypothesis is at least a reasonable one. The nostrils, as in true fishes, are superior. The body in these fishes is covered with rhombic enameled scales, as in the garpike, the head is similarly mailed, but in distinction from the garpike, the anterior rays of the dorsal are developed as isolated spines.

The young have a bushy external gill, with a broad scaly base. The air-bladder is double, not cellular, with a large air-duct joining the ventral surface of the œsophagus. The intestine has a spiral valve.

The cranium is remarkable for its generalized form, this forming a trait of union between the ganoids and the primitive *Amphibia* or *Stegocephali.* Without considering *Polypterus,* it is not possible to interpret the homologies of the cranium of the amphibians and the sharks.

Sub-class Dipneusti or Lung Fishes.—The *Dipneusti* (δίσ, twice; πνέω, to breathe) are a group characterized by the presence of paired fins consisting of a jointed axis with or without rays. The skull is autostylic, the upper jaw being made, as in the *Chimæra,* of palatal elements fused with the cranium and without premaxillary or maxillary. Dentary bones little developed. Air-bladder cellular, used as a lung, in all living species. Heart with many valves in the muscular arterial bulb. Intestine with a spiral valve. Teeth usually of large plates of dentine covered with enamel on the pterygopalatine and splenial bones. Nostrils concealed, when the mouth is closed, under a fold of the upper lip. Scales cycloid, mostly not enameled.

This group has been usually known as *Dipnoi.* But this term was first taken by Leuckart, in 1821. as a name for amphibians, before any of the living *Dipneusti* were known.

The *Dipneusti* agree with the crossopterygians by the presence of lungs, a character which separates them from all the earlier orders of fishes. In its origin the lung or air-bladder arises as a diverticulum from the alimentary canal used by the earliest fishes as a breathing-sac, the respiratory functions lost in the progress of further divergence. Nothing of the nature of lung or air-bladder is found in lancelet, lamprey or shark. In none of the remaining groups of fishes is it wholly wanting at all stages of development.

In the *Dipneusti* or dipnoans, as in the crossopterygians and higher vertebrates, the trachea or air-duct arises from the ventral side of the æsophagus. In the more specialized fishes, yet to be considered, it is transferred to the dorsal side, thus avoiding a turn in passing around the œsophagus itself. From the sharks these forms are further distinguished by the presence of membrane-bones about the head. From the *Actinopteri* (ganoids and teleosts) dipneustans and crossopterygians are again distinguished by the retention of the fringe-fin or archipterygium as the form of the paired limbs. From the crossopterygians the dipnoans are most readily distinguished by the absence of maxillary and premaxillary, the characteristic structures of the jaw of the true fish. The upper jaw in the dipnoan is formed of palatal elements attached directly to the skull, and the lower jaw contains no true dentary bones. The skull in the dipnoan, as in the *Chimæra* is autostylic, the mandible articulating directly with the palatal apparatus, the front of which forms the upper jaw, and of which the pterygoid hyomandibular and quadrate elements form an immovble part. The shoulder-girdle, as in the shark, is a single cartilage, but it supports a pair of superficial membrane-bones.

In all the dipnoans the trunk is covered with imbricated cycloid scales and no bony plates, although sometimes the scales are firm and enameled. The head has a roof of well-developed bony plates made of ossified skin and not corresponding with the membrane-bones of higher fishes. The fish-like membrane-bones, opercles, branchiostegals, etc., are not yet differentiated. The teeth have the form of grinding-plates on the pterygoid areas of the palate, distinctly shark-like in structure. The paired fins are developed as archipterygia, often without rays, and the pelvic arch consists of a single cartilage, the two sides symmetrical and connected in front. There is but one external gill-opening, leading to the gill-arches, which, as in ordinary fishes, are fringe-like, attached at one end. In the young, as with the embryo shark, there is a bushy external gill, which looks not unlike the archipterygium pectoral fin itself, although its rays are of different texture. In early forms, as in the ganoids, these scales were long and enameled, but in some recent forms, deep sunken in the skin. The claspers have disappeared, the nostrils, as in the frog, open into the pharynx, the heart is three-chambered, the arterial bulb with many valves, and the cellular structure of the skin and of other tissues is essentially as in the *Amphibia.*

The developed lung, fitted for breathing air, which seems the most important of all these characters, can, of course, be traced only in the recent forms, although its existence in all

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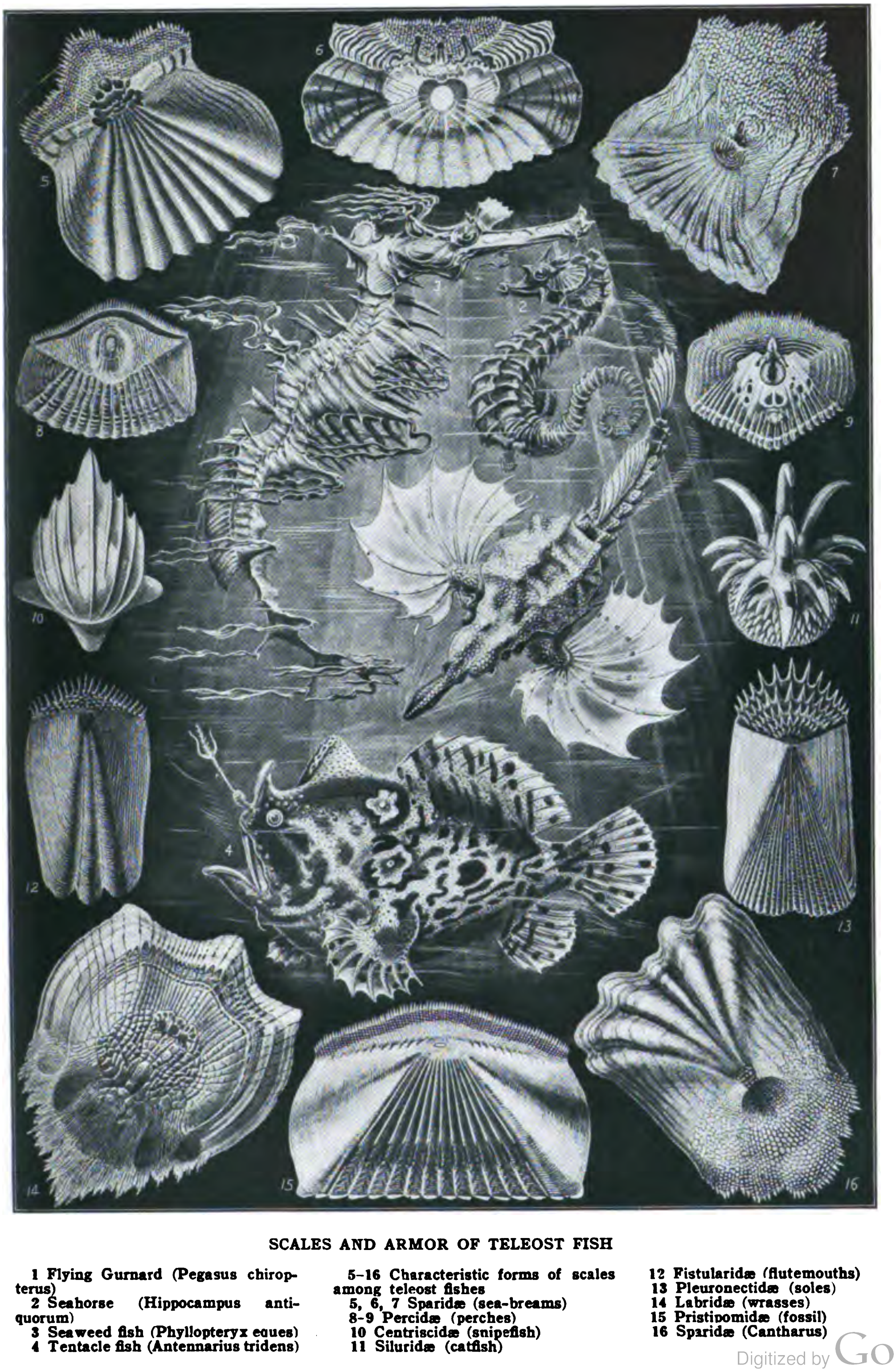


SCALES AND ARMOR OF TELEOST FISH

1 Flying Gurnard (Pegasus chiropterus)
2 Seahorse (Hippocampus antiquorum)
3 Seaweed fish (Phyllopteryx eques)
4 Tentacle fish (Antennarius tridens)
5–16 Characteristic forms of scales among teleost fishes
5, 6, 7 Sparidæ (sea-breams)
8-9 Percidæ (perches)
10 Centriscidæ (snipefish)
11 Siluridæ (catfish)
12 Fistularidæ (flutemouths)
13 Pleuronectidæ (soles)
14 Labridæ (wrasses)
15 Pristipomidæ (fossil)
16 Sparidæ (Cantharus)

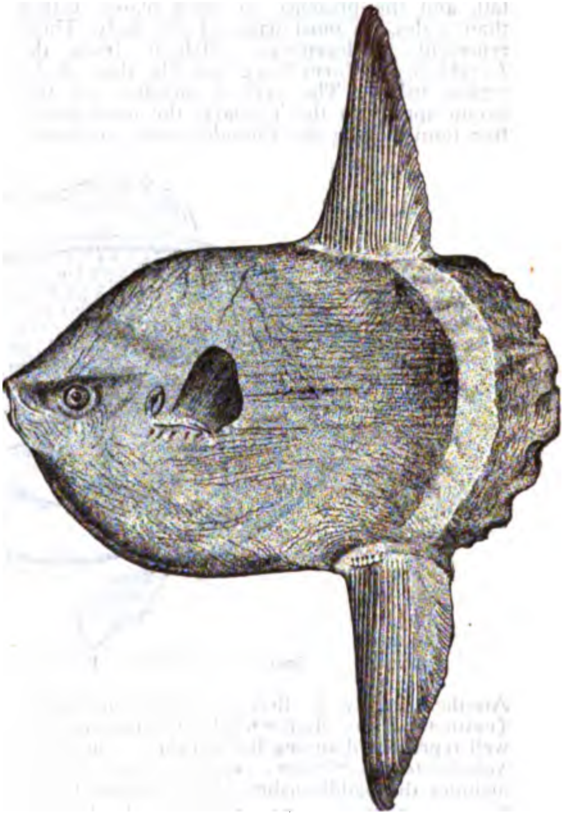
others can be safely predicated. Besides the development of the lung we may notice the gradual forward movement of the shoulder-girdle, which, in the dipneustans, as in the crossopterygians, is attached to the head. In the fishes generally there is no distinct neck, as the post-temporal, the highest bone of the shoulder-girdle, is articulated directly with the skull.

We may divide the dipnoans into two orders, *Ctenodipterini*, with the families *Uronemidæ* (extinct), *Dipteridæ* (extinct), and *Ctenodontidæ* (extinct). These families occur from the Devonian to the Mesozoic. The more specialized order of *Sirenoidei* includes the families of *Ceratodontidæ* and *Lepidosirenidæ*, each of these represented by living forms. Most of the *Ceratodontidæ* are extinct, occurring in the Mesozoic; but two species, *Neoceratodus forsteri* and *N. miolepis*, live in rivers of Australia. No fossil *Lepidosirenidæ* are known. *Lepidosiren paradoxus* lives in the swamps of southern Brazil and *Protopterus annectens*, *P. dolloi*, and *P. æthopicus*, in those of the Nile region.

Sub-class Actinopteri.—After setting off from the great group of fishes primitive or archaic types, one after another, we are left at last with only those having fish-jaws, fish-fins, and in general the structure of the typical fish. For all these in all their variety, as a class or sub-class, we adopt the name of *Actinopteri*, suggested by Prof. Cope. The name (ἀκτίς, ray; πτερόν, fin) refers to the structure of the paired fins. In all these, the bones supporting the fin-rays are highly specialized, and at the same time concealed by the general integument of the body.

In general, two bones connect the pectoral fin with the shoulder-girdle. The hyperacoracoid is a flat square bone, usually perforated by a foramen lying above, and parallel with it the irregularly formed hypocoracoid. Attached to these is a row of bones, the actinosts or pterygials, short, often hourglass-shaped, which actually support the fin-rays. In the higher forms the actinosts are few (four to six) in number, but in the lower types they may remain numerous, a reminiscence of the condition seen in the crossopterygians and especially in *Polypterus*. Other variations may occur; the two coracoids are sometimes imperfect or specially modified, and the actinosts may be distorted in form or position. Among the lower *Actinopteri* many archaic traits still persist, and by its earlier representatives the group is joined very closely to the *Crossopterygii*. The great class may be divided into two series or sub-classes, the *Ganoidei*, which retain ancient traits, and the *Teleostei* or bony fishes, in which most of these have disappeared.

Even among the *Ganoidei*, as the term is here restricted, there remains a great variety of form and structure. The group constitutes several distinct orders, and as a whole does not admit of perfect definition. All of the species known have the tail strongly heterocercal. Most of them have the skeleton still cartilaginous, and in some it remains in a very primitive condition. Most of them have an armature of bony plates, diamond-shaped with an enamel like the surface of teeth. All of them have the air bladder highly developed, usually cellular and functional as a lung, but connecting with the dorsa side of the gullet, not with the ventral side, as in the dipnoans. In all these remain more or less perfectly developed the optic chiasma, the many valves of the arterial bulb, and the spiral valve of the intestines found in the more archaic types. But traces of some or all of these structures are found in some bony fishes, and their presence in the ganoids by no means justifies their separation with sharks, dipnoans, and crossopterygians as a great primary class, *Palæichthyes* as proposed by Dr. Gunther. All forms of body may be found among the ganoids. In the earlier seas they were scarcely less varied and perhaps scarcely less abundant that the teleosts in the seas of to-day. So far as fossils show, the characteristic actinopterous fin, with its reduced and altered basal bones, appeared at once without intervening gradations.

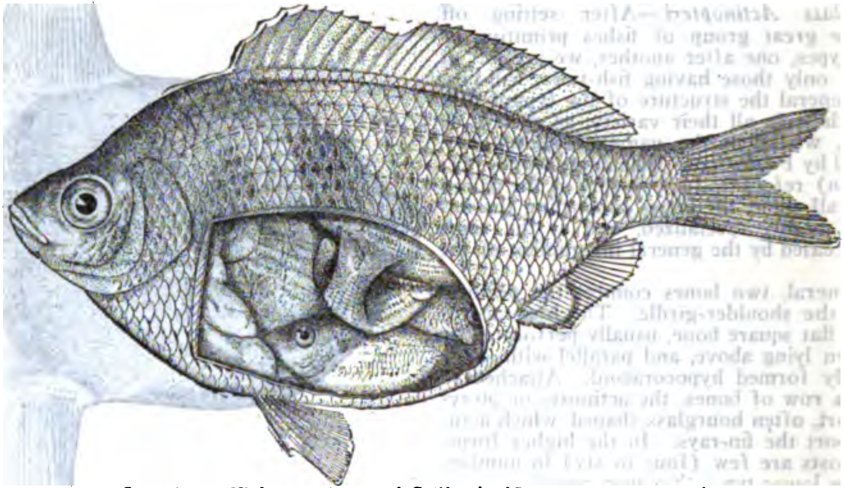


Oceanic Sunfish or Headfish (*Mola mola*).

The name *Ganoidei* (γάνος brightness; εἶδος, resemblance), alluding to the enameled plates, was first given by Agassiz to those forms, mostly extinct, allied to the garpike, and covered with bony scales or hard plates. As originally defined cat-fishes, sea-horses, *Agonidæ*, and other wholly unrelated types were included with the garpikes and sturgeons as ganoids.

These were eliminated by Johannes Müller, who recognized the archaic characters common to the existing forms. Still later Huxley removed the crossopterygians, and others have shown that the *Ostracophori* and *Arthrodira* should be placed far from the garpike in systematic classification. Cope and Woodward have dropped the name ganoid altogether as productive of confusion through the many meanings attached to it. Others have used it as a handy group name for the orders of archaic *Actinopteri*. For these varied and more or less divergent groups it seems convenient to retain it.

The order *Lysapteri* (λύοις, a loosing; πτερόν, fin) comprises the earliest ganoids, beginning in the Devonian which have the body covered with enameled scales. The families are *Palæoniscidæ*, *Platysomidæ*, *Dictyopygidæ* and *Dorypteridæ*. The order *Chondrostei* (χόνδρος, cartilage; ὀστέον, bone, includes a great variety of forms, characterized by the less cartilaginous skeleton, the distinctly heterocercal tail, and the presence of bony plates, rather than scales, on most parts of the body. These represent a degenerate offshoot from the *Lysopteri*, the form being less like that of the typical fishes. The earliest members of this group appear in the Tertiary, the most primitive family being the *Chondrosteidæ* (extinct).



Sparada, or Viviparous Perch of California (*Cymatogaster aggregatus*).

Another family is that of *Belonorhynchidæ* (extinct). The *Acipenseridæ* (sturgeons) are well represented among living fishes. The order *Selachostomi* (σέλαχος, shark; στόγα, mouth) includes the paddle-fishes (*Polyodontidæ*), two living species, and one extinct, in the Eocene. The order *Pycnodonti* including the family of *Pycnodontidæ* (extinct), consists of a deep-bodied, compressed fishes with small mouths and a peculiar physiognomy. The order *Lepidostei* (γεπίς, scale; ὀστέον, bone) includes numerous families with rhombic enameled scales. The families are *Semionotidæ*, *Lepidotidæ*, *Isopholidæ*, *Macrosemiidæ*, *Pholidophoridæ*, *Aspidorhynchidæ*, and *Lepisosteidæ*, all extinct save the *Lepisosteidæ*, represented by four species known as garpike in the rivers of North America. The earliest fossil garpikes occur in the Eocene. The *Halecomorphi* (*halec*, herring; γορφή, form) comprise the *Pachycormidæ* *Protosphyrænidæ*, *Liodesmidæ*, *Oligopleuridæ*, and *Amiidæ*. All these have perished, except the *Amiidæ*, which group is represented by a single species, the Bowfin, *Amia calva* (*Amiatus calvus*), in the waters of the eastern United States. In these forms there is a gradual transition from diamond-shaped scales, covered with enamel, to the cycloid scales of the ordinary soft-rayed fishes. The line separating the *Lepidostei* and *Halecomorphi* from each other and from the *Isospondyli* is a very narrow one.

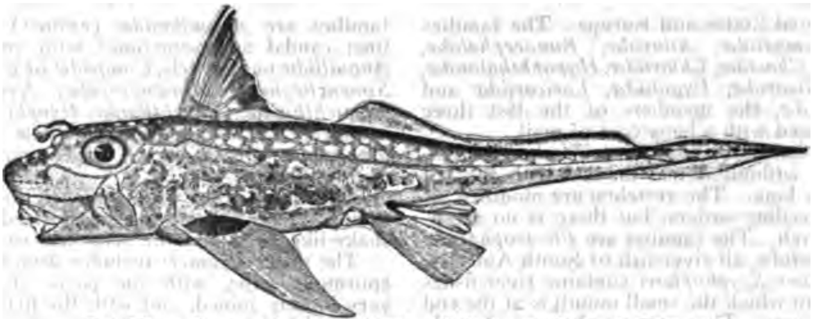
Sub-class Teleostei or Bony Fishes.— The fishes which still remain for discussion constitute the great sub-class or series of *Teleostei* or bony fishes. They lack wholly or partly the ganoid traits, or show them only in the embryo. The tail is slightly if at all heterocercal, the fulcra disappear, the actinosts of the pectoral fins are few and large, rarely if ever over five in number, the air-bladder is no longer cellular in most species, nor does it assist in respiration. The optic nerves are separate, one running to each eye without chiasma. The skeleton is almost entirely bony, the notochord usually disappearing entirely with age. The valves in the arterial bulb are reduced in number, and the spiral valve of the intestines disappears. Traces of each of the ganoid traits may persist somewhere in some group, but as a whole we see a distinct specialization and a distinct movement toward the fish type with the loss of characters distinctive of sharks, dipnoi, and ganoids. In a general way the skeleton of all teleosts corresponds with that of the striped bass, and the visceral anatomy is in all cases sufficiently like that of the sunfish.

The mesocoracoid or præcoracoid arch, found in all ganoids, persists in the less specialized types of bony fishes, although no trace of it is found in the perch-like forms. With all this there is found among the bony fishes, an infinite variety in details of structure. For this reason the *Teleostei* must be broken into many orders and these orders are very different in value and in degrees of distinctness, the various groups being joined by numerous and puzzling intergradations.

Order Isospondyli.— Of the various subordinate groups of bony fishes there can be no question as to which is most primitive in structure or as to which stands nearest the orders of ganoids. Earliest of the bony fishes in geological time is the order of *Isospondyli* (ἴσος equal; σπόνδυλος vertebra), containing the allies recent and fossil of the herring and the trout. This order contains those soft-rayed fishes which have the ventral fins abdominal, the mesocoracoid or præcoracoid arch developed (sometimes lost in degeneration), and the anterior vertebræ unmodified, essentially similar to the others.

The ganoids pass by degrees into the *Isospondyli*, and the soft-rayed fishes pass again by imperceptible gradations into those more specialized forms having spines in the fins structures which are again lost in the most modified members of the same group.

Ganoid traits are present in certain families of *Isospondyli*. Among these are the gular plate (found in *Amia* and the *Elopidæ*), presumably derived from the similar plate in the earliest ganoids, additional valves in the arterial bulb in *Albulidæ*, the cellular air bladder of *Notopterus* and *Osteoglossum*, the spiral intestinal valve in *Chirocentridæ*, and the ganoid scales of the extinct *Leptolepidæ*. From these characters it is inferred that the soft-rayed fishes are descended from the *Lepidostei* or *Halecomorphi*. The more primitive *Isospondyli* approach more nearly to these ganoid forms than to their later descendants, the catfishes, the eels, or the pikes.



Rat-fish or Elephant-fish of California (*Hydrolagus colliei*). A Chimaeroid.

Most ancient of the *Isospondyli* is the extinct family of *Leptolepidæ* of the Triassic. Families mostly still extant, but nearly all of them more or less represented in fossils from the Jurassic on, are the *Elopidæ* or tarpons, the *Albulidæ* or lady-fishes, the *Chanidæ* or milk-fishes, the *Hiodontidæ* or moon-eyes, the *Spaniodontidæ* (extinct), the *Pachyrhizodontidæ* (extinct), the *Thryptodontidæ* (extinct) the *Pterothrissidæ*, the *Chirocentridæ*, the *Notopteridæ*, the *Enchodontidæ* (extinct), the *Ichthyodectidæ* (extinct), the *Osteoglossidæ*, the *Phareodontidæ* (extinct), the *Clupeidæ* or herrings, the *Dussumieriidæ* or round herrings, the *Dorosomidæ* or gizzard-shad, the *Engraulidæ* or anchovies, the *Alepocephalidæ*, the *Pantodontidæ*, the *Salmonidæ* or salmon and trout, the *Thymallidæ* or graylings, the *Argentinidæ* or smelt, the *Microstomidæ*, the *Salangidæ* or ice-fish, the *Galaxiidæ* or New Zealand trout, the *Happlochitonidæ*, the *Gonorhynchidæ*, the *Notopteridæ*, and a host of other forms, mostly from the deep seas, constituting (sub-order *Iniomi*) the families of *Aulopidæ*, *Ctenothrissidæ* (extinct), *Synodontidæ* or lizard-fishes, *Benthosauridæ*, *Bathypteroidæ*, *Ipnopidæ*, *Rondeletiidæ*, *Cetomimidæ*, *Myctophidæ* or lantern-fishes, *Rhinellidæ* (extinct), *Dercetidæ* (extinct), *Chirothrissidæ* (extinct), *Exocoetoididæ* (extinct), *Maurolicidæ*, *Chauliodontidæ* or viper fishes, *Gonostomidæ*, *Astronesthidæ*, *Stomiatidæ*, *Malacosteidæ*, *Plagyodontidæ* or lancet-fishes, *Evermannellidæ*, *Paralepididæ*, *Sternoptychidæ* and *Idacanthidæ*.

The order of *Lyopomi* (λύω, loose, πόγα, opercle), contains a few deep-sea fishes, without mesocoracoid and with the opercular bones distorted. One family, the *Halosauridæ*, with fossil allies.

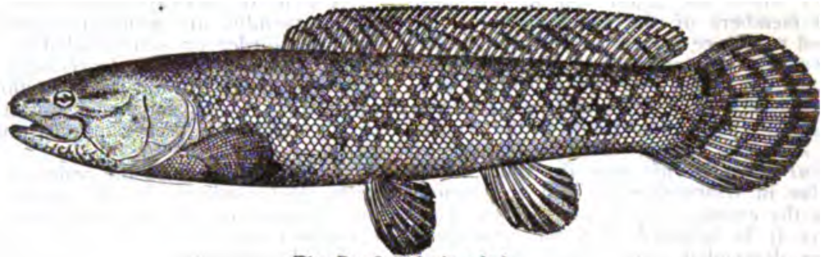
A series of soft-rayed fishes descended from the *Isospondyli* are grouped together to form the super-order or series called *Ostariophysæ*. These differ from the *Isospondyli* in having families of *Characidæ* and *Erythrinidæ*, the air-bladder being connected, by a series of ossicles called the Weberian apparatus, with the auditory organ.

This series includes the orders of *Eventognathi*, *Heterognathi*, *Nematognathi*, and *Gymnonoti*, immense groups comprising the vast majority of the fresh-water fishes of the world.

The *Eventognathi* and *Heterognathi* have the mouth-parts normal, the maxillary not rudimentary, and the body usually covered with ordinary scales. In the order *Heterognathi* (ἕτερος differing; γνάθος, jaw) the lower pharyngeals are not especially modified, and the jaws usually with teeth. This group comprises most of the river-fishes of South America and Africa with multitudes of genera and species. It includes the families of *Characidæ* and *Erythrinidæ*, the former with and the latter without the adipose fin characteristic of catfishes and salmon.

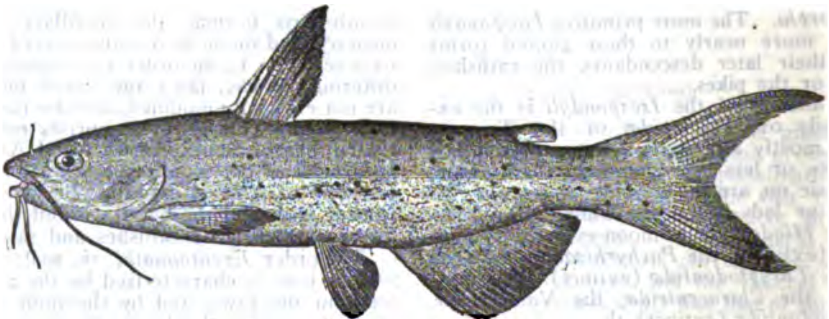
The order *Eventognathi* εὐ, well; ἐν, within; γνάθος, jaw, is characterized by the absence of teeth in the jaws, and by the high degree of specialization of the lower pharyngeals, which are scythe-shaped, and in typical forms are armed with a relatively small number of highly specialized teeth of peculiar forms and arranged in one, two or three rows. In all the species the gill-openings are restricted to the sides. there is no adipose fin, and the broad flat branchiostegals are but three in number. In all the species the scales, if present, are cycloid, and the ventral fins, of course, abdominal. The modification of the four anterior vertebræ and their connection with the air-bladder are essentially as seen in the catfishes. The families of *Eventognathi* are the *Kneriidæ*, *Homalopteridæ*, *Cobitidæ* or loaches, *Catostomidæ* or suckers, and *Cyprinidæ* or carp, dace and minnows. The last is the largest family recognized in ichthyology, comprising over 2,000 species, almost all confined to the north temperate zone.

The order of *Nematognathi* or catfishes is characterized among the *Ostariophysæ* by the fact that the maxillary bone is rudimental, forming the base of a long barbel. There are no true scales, the body being naked or mailed, and about the mouth are always fleshy feelers. The multitude of species inhabit chiefly the rivers of the tropics, only the typical catfishes of the principal family of *Siluridæ* occurring in waters of the United States and Europe. The families are *Diplomystidæ, Siluridæ, Bunocephalidæ, Plotosidæ, Chacidæ, Chlariidæ, Hypophthalmidæ, Argidæ, Sisoridæ, Pygidiidæ, Loricariidæ* and *Calliththyidæ*, the members of the last three groups armed with a bony coat of mail.


The Bowfin (*Amia calva*).

The order *Gymnonoti* contains elongate eel-like fishes without dorsal fin and with the tail excessively long. The vertebræ are modified, as in the preceding orders, but there is no mesocoracoid arch. The families are *Electrophoridæ* and *Gymnotidæ*, all river-fish of South America.

The order *Scyphophori* contains river-fishes of Africa in which the small mouth is at the end of a long snout. There are no pharyngeal teeth, and the opercular bones are considerably modified. In all there is a deep cavity on each side of the cranium, covered by a thin bony plate, the supertemporal bone. The families are *Mormyridæ* and *Gymnarchidæ*.


Channel Cat-fish (*Ictalurus punctatus*).

Next we may place a long series of more or less related families, known collectively as eels. In all these the upper jaw is more or less degenerate, the ventral fins are wanting, and the shoulder-girdle has typically lost its connection with the skull. The earliest fossil eels have traces of scales, the caudal fin separate, and, according to Dr. O. P. Hay, abdominal ventral fins. These characters are lost in all or most of the living forms.

The eels may be distributed among different orders. The *Symbranchia* (σὺν together; βράγχος, gill)—*Ichthyocephali*, and *Holostomi*—have normal fish-like jaws, and the shoulder-girdle is sometimes joined to the skull. The families are *Monopteridæ* or rice-field eels, *Symbranchidæ, Amphipnoidæ and Chilobranchidæ*.

The true eels or apodes have the shoulder-girdle free from the skull, the premaxillaries more or less coalesced with the vomer, and the body elongate and of many vertebræ. The families are *Anguillavidæ* (extinct) with distinct caudal and sometimes with ventral fins, *Anguillidæ* or true eels, *Congridæ* or conger-eels, *Simencheylidæ, Murænesocidæ, Nettasomidæ, Nemichthyidæ, Ophichthyidæ, Ilyophidæ, Heterocongridæ, Dysommidæ Encheliidæ* (extinct), *Murænidæ* or morays, *Myrocongridæ* and *Moringuidæ*.

The small order of *Carencheli* contains one family, *Derichthyidæ*, characterized by the snake-like neck and the structure of the jaws.

The order *Lyomeri* includes deep-sea eels of enormous gape, with the parts of the head very loosely joined, and with the fifth gill-arch not modified to form a pharyngeal. There are two families, *Saccopharyngidæ* and *Eurypharyngidæ*.

Still more aberrant is the small order of *Heteromi* (ἕτερος differing; ὦμος shoulder), the spiny eels, elongate fishes, having the shoulder-girdle detached from the head and the coracoids united in an imperforate plate. This group includes eel-like fishes of the deep sea, with spines in the dorsal fin — the families, *Protonotocanthidæ* (extinct), *Notacanthidæ* and *Lipogenyidæ*.

Another order of uncertain relationship is that of *Opisthomi*, with normal coracoids, spines in the dorsal fin, and the shoulder-girdle remote from the skull. It contains one family, the *Mastacembelidæ,* small fishes from the streams of tropical Asia and Africa.

Another small order, the *Xenomi* (ξένος strange; ὦμος shoulder), has the coracoids rudimentary and cartilaginous, with no basal bones or actinosts to the pectoral fin. One family, *Dalliidæ,* containing the black-fish of the marshes of Alaska and Siberia.

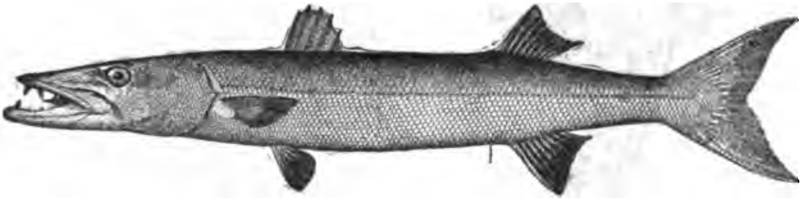
In the order *Haplomi,* the mesocoracoid arch is wholly undeveloped, as is the case in all of the other groups remaining to be enumerated.

Muræna.

In common with the soft-rayed fishes in general, the air-bladder has a persistent air-duct, the fins are without spines, the ventral fins are abdominal and the scales are cycloid.

There is no adipose dorsal in the *Haplomi,* the dorsal is inserted far back, and the head is generally scaly. Most, but not all, of the species are of small size, living in fresh or brackish waters, and they are found in almost all warm regions, though scantily represented in California, Japan and Polynesia. The families are *Esocidæ* or pikes, *Umbridæ* or mud-minnows, *Poeciliidæ* or killifishes, and *Amblyopsidæ* or blind-fishes of the caves. The *Gonorhynchidæ* and the extinct families of *Crossognatahidæ* and *Cobitopsidæ* may be doubtfully added to this group.

Order Acanthopterygii.— The most of the remaining bony fishes constitute a natural group for which the name *Acanthopterygii* (ἄκανθα, spine; πτερόν fin or wing), may be used. This name is often written *Acanthopteri,* a form equally correct and more euphonious and convenient. These are characterized, with numerous exceptions, by the presence of spines in the fins, by the connection of the ventral fins to the shoulder-girdle, by the presence, in general, of more than one spine in the anterior part of dorsal and anal fins, and as a rule of one spine and five rays in the ventral fins, and by the absence in the adult of a duct to the air-bladder. Minor characters are these: The pectoral fins are inserted high on the shoulder-girdle, the scales are often ctenoid, and the edge of the upper jaw is formed by the premaxillary alone, the maxillary being always toothless.



Barracuda (*Sphyræna barracuda*)

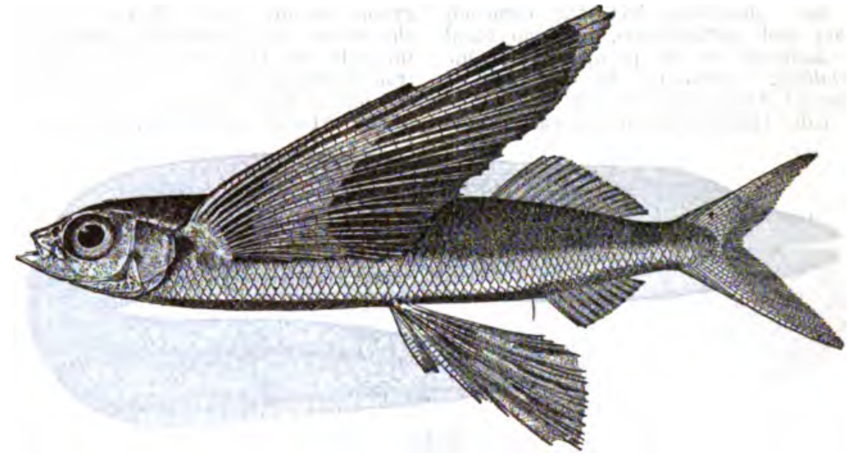
But it is impossible to define or limit the group by any single character or group of characters. It is connected with the *Isospondyli* through the *Haplomi,* on the one hand, by transitional groups of genera which may lack any one of their characters. On the other hand, in the extreme forms, each of these distinctive characters may be lost through degeneration. Thus fin-spines, ctenoid scales and the homocercal tail are lost in the cod-fishes, the connection of ventrals with shoulder-girdle fails in certain peculiar forms, and the development of the air-duct is subject to all sorts of variations. In one family even the adipose fin reappears.

The *Acanthopterygii* or preferably *Acanthopteri,* the *Physoclysti* of Müller, the *Thoracices* of older authors, and the *Ctenoidei* of Agassiz, include substantially the same series of forms.

Among the many subordinate groups, sub-orders or super-families, a few stand out as susceptible of definition. Among these is the group of *Salmopercæ,* composed of perch-like fishes, with spines in the fins and with ctenoid scales, yet retaining at the same time the abdominal ventrals and the adipose fin of the salmon. This constitutes the family of *Percopsidæ,* trout-perches or sand-rollers. The extinct *Erismatopteridæ* and *Asineopidæ* probably belong here.

The sub-order *synentognathi* agree externally with the *Haplomi,* but have the lower pharyngeals solidly united, and the air-duct lost in the course of development. The families are *Belonidæ,* the gars, *Scombresocidæ,* the sauries, *Hemiramphidæ* or half-beaks, and *Exocœtidæ* or flying-fishes. This order and the *Haplomi* are joined by Hay under the name of *Mesichthyes,* the groups forming a perfect transition from soft-rayed to spiny-rayed fishes.

The group of *Percesoces* has the general traits of the spiny-rayed fish, with the ventral fins abnormal. Here belong the *Sphyrænidæ* or barracudas, the *Atherinidæ* or silversides, and the *Mugilidæ* or mullets. Another sub-order, *Rhegnopteri,* includes the *Polynemidæ* or thread-fins. Other transitional forms, with the ventrals abdominal, and spines usually present in the fins, constitute the sub-orders of *Hemibranchii, Lophobranchii* and *Hypostomides.* In all of these the bones of the gill-arches are reduced in number, and the gill-structures are distinctly degenerate. For this reason Dr. Hay has proposed to unite them as a distinct order. *Phthinobranchii* (φθίνων, waning). The *Hemibranchii* include the families *Gasterosteidæ* (sticklebacks), *Protosyngnathidæ* (extinct), *Aulorhynchidæ, Fistulariidæ* (cornet fishes), *Aulostomidæ* (trumpet-fishes), *Urosphenidæ* (extinct), *Rhamphosidæ* (extinct), *Marcorhamphosidæ* (snipe-fishes), and *Centriscidæ* (shrimp-fishes). The more degenerate sub-order of *Lophobranchii* includes the *Solenostomidæ,* the *Syngnathidæ* (pipe-fishes), and the *Hippocampidæ* or sea-horses. The singular order of *Hypostomides* includes the *Pegasidæ* (sea-moths or sea-dragons).



A Flying-fish (*Cypselurus speculiger*).

A Sea-horse (*Hippocampus*).

In another sub-order we may place the *Berycoidei,* fishes perch-like in general structure and usually well armed, with the ventral fins thoracic, but their number of rays never I, 5, the typical number in all perch-like forms. The berycoids are especially characterized by the presence of the orbitosphenoid bone, a structure wanting in all perch-like families; are the earlies in time of the fishes of this pattern, appearing in the Cretaceous or earlier. The families are *Berycidæ, Trachichthyidæ, Holocentridæ* or soldier-fishes, *Polymixiidæ,* and *Monocentridæ* or pine-cone fish.

Another group or sub-order *Zeoidei,* agrees well with the beryces in the presence of more than five soft rays in the ventral fins and in the armature of the fins. It differs, however, in the character of the skeleton, the post-temporal, especially being adnate to the skull, as in the butterfly-fishes or *Chætodontidæ.*

One family, *Zeidæ,* the John-dories, belongs here. In the same group we may place provisionally an extinct family, *Amphistiidæ.* Dr. Boulenger has suggested that to fishes allied to the *Amphistiidæ* we may trace the origin of the John-dories, and of the great group of flounders as well. This is an interesting suggestion, but the actual line of descent is as yet not proved.

The sub-order *Selenichthyes* includes the family of *Lampridida* or opahs. In this group is a single species, a huge fish almost as deep as long, with the hypercoracoids greatly developed and the ventral fin with many soft rays, an archaic character unknown in other spiny-rayed fishes.

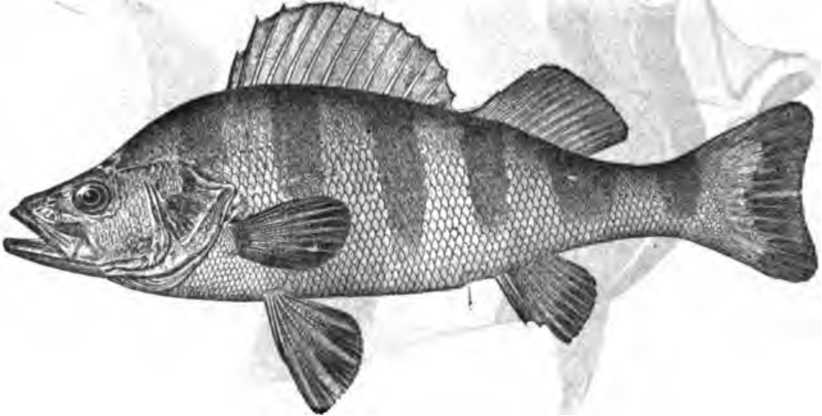
In this neighborhood perhaps belongs the sub-order of *Heterosomata*, or flounders, characterized by the twisting of the cranium, an arrangement which permits the fish to lie flat on one side on the sand, while both eyes are turned to the upper or colored side. In this group there are no fin-spines. The young flounder when first hatched has the skull and eyes symmetrical, and the modification of the head proceeds by degrees.

Mackerel (*Scomber scombrus*).

There are two families, *Pleuronectidæ* or flounders, and *Soleidæ* or soles.

To the group or super-family *Scombroidea* belong a great variety of fishes, usually swift in motion and with thin soft scales, the ventral fins, if present, having a spine and five soft rays.

The families are *Rachicentridæ*, the sergeant-fishes, *Pomatomidæ* or bluefishes, *Carangidæ* or Cavallas, *Nematistiidæ* or papagallos, *Scombridæ* or mackerels, *Palæorhynchidæ* (extinct), *Lepidopidæ* or scabbard-fishes, *Trichiuridæ* or cutlass-fishes, *Istiophoridæ* or sail-fishes, *Xiphiidæ* or sword-fishes, *Coryphænidæ* or dolphins, *Bramidæ* or pomfrets, *Pteraclididæ*, *Stromateidæ* or harvest-fishes, *Icosteidæ* or rag-fishes, *Acrotidæ*, *Zaproridæ*, *Louvaridæ* or Louvars, *Menidæ*, *Leiognathidæ*, *Steinegeriidæ*, and *Tetragonuridæ* or square-tails. The *Grammicolepidæ* perhaps belong in this neighborhood.

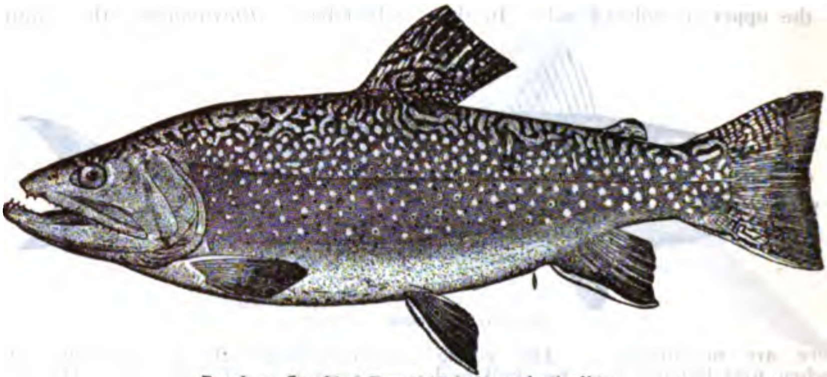

Yellow Perch (*Perca flavercens*).

The imperfectly known families, *Bathyclupeidæ*, *Stephanoberycidæ* and *Pempheridæ* have some resemblance to berycoids, but the ventral rays are I, 5.

The great group or super-family *Pericoidea* agrees with the mackerel-like fishes in general structure, but the scales are usually coarser and rougher, and the structure less adapted to swift movement. Many members of this group are confined to the fresh waters. The families are *Centrarchidæ*, the sunshines, *Kuhliidæ*, the silver-bass, *Elassomidæ*, the pigmy-perch, *Aphredoderidæ*, the pirate-perch, *Percidæ*, the river-perch and darters, *Apogonidæ*, the beardless mullets, *Scombropidæ*, *Acropomidæ*, *Serranidæ*, the bass, *Lobotidæ*, the flashers, *Rypticidæ*, the soap-fishes, *Kyphosidæ*, the chopas, *Scorpididæ*, *Theraponidæ*, the slave-fishes, *Hæmulidæ*, the grunts, *Lutianidæ*, the snappers, *Sparidæ*, the porgies, *Cæsionidæ*, *Gerridæ*, the mojorras, *Mænidæ*, the picarels, *Sciænidæ*, the drums, *Centropomidæ* (or *Oxylabracidæ*), the robalos, *Polycentridæ*, *Nandidæ*, *Oplegnathidæ* or stone-wall perch, *Sillaginidæ*, *Pentacerotidæ*, *Priacanthidæ*, the catalufas, *Mullidæ*, the surmullets. Remotely allied to the percoid fishes are the *Pseudochromididæ*, the *Opisthognathidæ* or jaw-fishes, the *Malacanthidæ*, the *Latilidæ* or tile-fishes, and possibly the *Cepolidæ* or band-fishes.

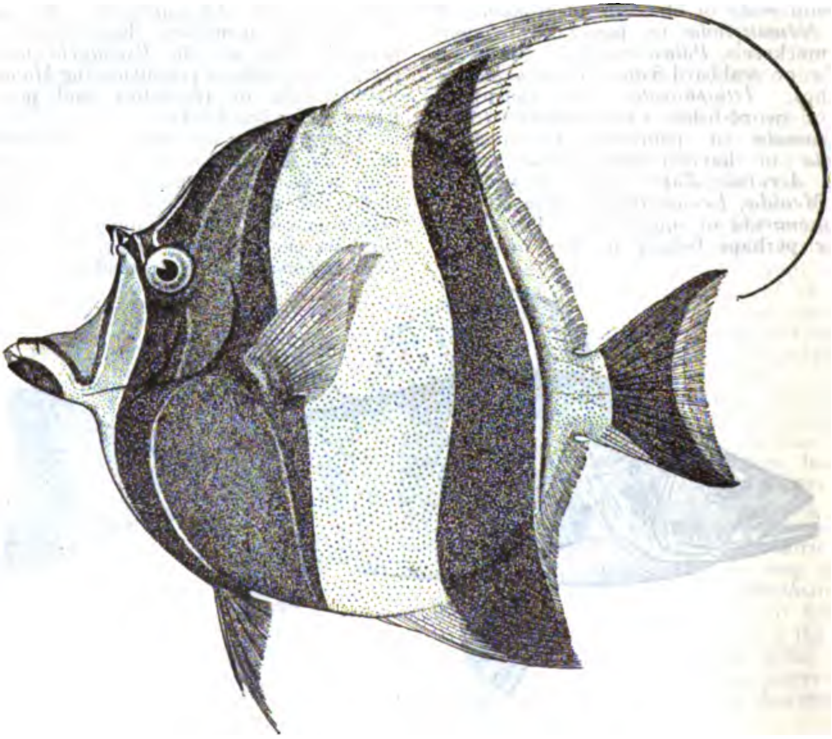
The group or sub-order of *Labyrinthici* comprises fresh-water fishes of the Indian region, with a peculiar apparatus for storing water connected with the gills. The families are *Osphromenidæ* or gouramies, *Anabantidæ* or climbing perch, *Helostomidæ*, *Luciophalidæ*, and *Ophiocephalidæ* or snakehead-fishes.

Another group, called *Pharyngognathi* by Müller, is characterized by the complete union of the lower pharyngeals, a character developed independently in the *Synentognathi* and in some *Sciænidæ*. It contains three sub-orders or super-families. The *Chromides* have a single nasal opening on either side. Of these there are two families, the *Pomacentridæ* or damsel-fishes, chiefly beautiful inhabitants of the coral reefs, and the *Cichlidæ*, river-fishes of the tropics of both continents.


Brook or Speckled Trout (*Salvelinus fontinalis*).

The *Holconoti* comprise the viviparous perch or surf-fishes of California and Japan; one family, *Embiotocidæ*.

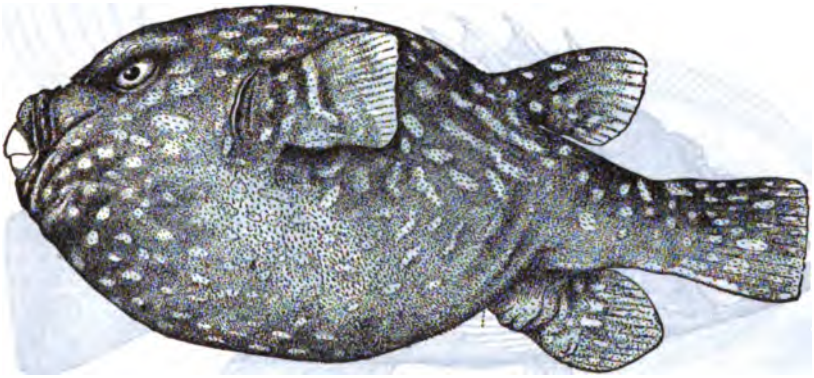
The *Pharyngognathi* proper, having two nostrils on either side, smooth scales and the gills three and one-half, constitute four families, *Labridæ*, wrasse-fishes or doncellas, *Odacidæ Siphonognathidæ* and *Scaridæ* (Callyodontidæ) or parrot-fishes, in which the teeth are united to form a bird-like beak.


Moorish Idol (*Zanclus cornutus*).

A large group of more or less related forms, perhaps derived from ancestors of the *Zeoidea*, is known as *Squamipinnes* or *Chætodontoidea*. These are characterized in general by the union of the post-temporal or uppermost bone of the shoulder-girdle with the skull. The ventral fins in these fishes have one spine and five (rarely fewer) rays. The scales are small and often rough. The presence in the more primitive forms of 24 vertebræ and five soft rays in the ventrals indicates the common origin of these fishes with the members of the scombroid, percoid and labroid groups. While the more primitive of the chætodontoid series much resemble primitive members of the other series, the extremes of the former represent a wide divergence, specialization and degeneration.

The typical families are the *Ilarchidæ* or spade-fishes, the *Chætodontidæ* or butterfly fishes, characteristic of coral reefs, and the *Zanclidæ* or Moorish idols. Aberrant types are the *Toxoidæ* or arches, *Ephippidæ* (*Scatophagidæ*), *Antigoniidæ* or boar-fishes and *Drepanidæ*. Still more aberrant are the *Acanthuridæ*, tangs or surgeon-fishes, the *Siganidæ*, with the last ventral rays spinous like the first. From the tangs are descended the degenerate types known collectively as *Plectognathi*, the bones of the jaws being more or less consolidated. Three sub-orders exist among these forms, *Sclerodermi*, with separate rough scales and separate teeth, the *Ostracodermi*, with the body enclosed in a bony box, and the *Gymnodontes*, with the teeth coalescent into one or two plates in each jaw.

To the *Sclerodermi* belong the three families, *Triacanthidæ*, *Balistidæ* or trigger-fishes, and *Monacanthidæ* or file-fishes. To the *Ostracodermi* belong the *Ostraciidæ* or trunk-fishes, and to the *Gymnodontes*, the *Triodontidæ*, the *Tetraodontidæ* or globefishes, the *Tropidichthyidæ*, the *Chonerhinidæ*, the *Diodontidæ* or porcupine fishes, the *Heptadiodontidæ* (extinct), and the *Molidæ* or head-fishes.



A Californian Globefish (*Ovoides setosus*).

A small group known as the super-family *Cirrhitoidea* is characterized by the thickened and unbranched character of the lower pectoral rays, the third suborbital being at the same time not enlarged. Here belong the *Cirrhitidæ*, the *Aplodactylidæ*, the *Latrididæ* and possibly the *Trichodontidæ*. This group seems to mark a direct transition from the perch-like fishes to those with mailed cheeks.

The sub-order of mailed-cheek fishes, *Pareioplitæ*, is characterized by the presence of the suborbital stay, a process extending backward from the third suborbital to or toward the upward limb of the preopercle. This stay is subject to great exaggeration in some forms, while in others it is much reduced. It is, however, always present in these fishes and in no others. In the more primitive types the ventrals have one spine and five rays. There are 24 vertebræ, and the scales are normally developed. In the extremes there are remarkable cases of specialization on the one hand and of degeneration on the other.

The families of mailed-cheek fishes are the *Caracanthidæ*, the *Hexagrammidæ* or greenfishes, the *Anoplopomidæ* or skil-fishes, the *Zaniolepidæ*, the *Ophiadontidæ* or "blue cod," the *Erilepidæ* or "fat priest" of Japan, the *Scorpænidæ* or rose-fishes and sea-scorpions, the *Platycephalidæ*, the *Bembridæ*, the *Hoplichthyidæ*, the *Cottidæ* or sculpins, the *Cyclopteridæ* or lump-fishes, the *Liparididæ* (*Cyclogasteridæ*) or sea-snails, the *Rhamphocottidæ* the *Agonidæ*, sea-poachers or alligator-fishes, the *Triglidæ* or sea-robins, the *Peristediidæ* and the *Cephalacanthidæ* or flying gurnards. The last three families differ considerably in osteology, and are segregated by Dr. Gill as the sub-order *Craniomi*.

In the sub-order *Discocephali* the spinous dorsal fin is modified to form a sucking disc. This is placed on the head, and is made of two series of flat plates. There is one family, the *Echineididæ* or remoras.

The large family of *Gobiidæ* forms a super-family called *Gobioidea*. The gobies are distinguished by numerous minor traits, the restricted gill-openings, the short spinous dorsal and usual connection of the ventral fins among others. With the gobies may be associated the small family of *Oxudercidæ*.

To the sub-order *Jugulares* we may refer many families which agree in having the ventral fins inserted before the pectorals. The super-family *Trachinoidea* for the most part retain the normal number of ventral rays, the spine and five soft rays. To this group belong the *Trachinidæ* or weavers, the *Uranoscopidæ* or stargazers, the *Percophidæ*, *Notothenidæ*, *Pteropsaridæ*, *Harpagiferidæ*, *Chænichthyidæ*, *Champsodontidæ*, *Bovichthyidæ*, the *Draconettidæ*, *Callionymidæ* or dragonets, the *Platyptteridæ*, and perhaps the *Chiasmodontidæ* and *Hemerocætidæ*.

Other divergent or aberrant families in this neighborhood are the *Comephoridæ* or Baikal-fishes, the *Bathymasteridæ* or ronquils and the *Gadopsidæ*. The *Batrachoididæ* or toad-fishes represent the group *Haplodoci*.

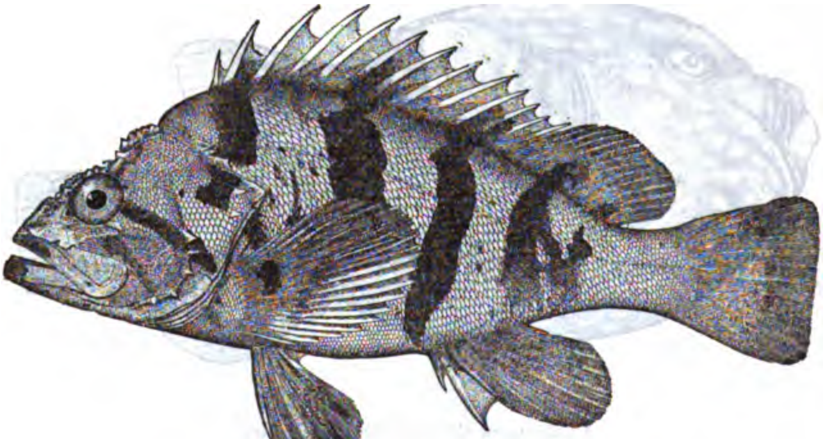
The group *Xenopterygii*, without spinous dorsal and with a large sucking disc between the ventral fins, contains the *Gobiesocidæ* or cling-fishes.

The super-family *Blennioidea* contains the blennies and their relatives, with the ventrals jugular and always few-rayed. Here belong the *Blenniidæ, Pholididæ, Stichæidæ, Xiphasiidæ, Cryptacanthodidæ* or wry-mouths, *Anarrhichadidæ* or wolf-fishes, *Ptilichthyidæ, Cerdalidæ, Patæcidæ, Gnathanacanthidæ* and the extinct family of *Blochiidæ*.

Very closely allied to the blennoid series, and also belonging to the *Jugulares*, is the super-family *Ophidioidea*, differing in the absence of fin-spines. Here belong the *Zoarcidæ* or eel-pouts, the *Ammodytidæ* or sand-launces, the *Bleekeriidæ*, the *Brotulidæ*, the *Brotulophidæ*, the *Ophidiidæ* or cusks, the *Fierasferidæ* or pearl-fishes, the *Xenocephalidæ, Scytalinidæ, Congrogadidæ* and *Bregmacerotidæ*.

A sub-order of uncertain relations, characterized by the absence of foramen in the hypercoracoid, by the peculiar form of the tail, by the jugular insertion of the ventrals and the absence of spines, is the *Anacanthini*. Here belong the *Gadidæ* or codfishes, the *Merlucciidæ* or hakes, the *Macruridæ* or grenadiers, the *Ateleopodidæ* and *Bathyonidæ*.

Still more uncertain are the relationships of the sub-order *Tæniosomi*, ribbon-shaped fishes of the deep sea, soft in body and often reaching an immense size. The families are *Trachypteridæ* or deal-fishes, *Regalecidæ* or oar-fishes. The *Lophotidæ* or crest-fishes show some resemblances to these.



Black-banded Rock-fish (*Sebastodes nigroicinctus*).

Finally we may close the long series with the order of *Pediculati*. These are jugular fishes, degenerate in structure, the small gill-opening behind the pectoral fins. The families are *Lophiidæ*, the anglers, *Antennariidæ* or walking-fishes, *Ceratiidæ* or sea-devils, and *Ogcocephalidæ* or sea-bats.

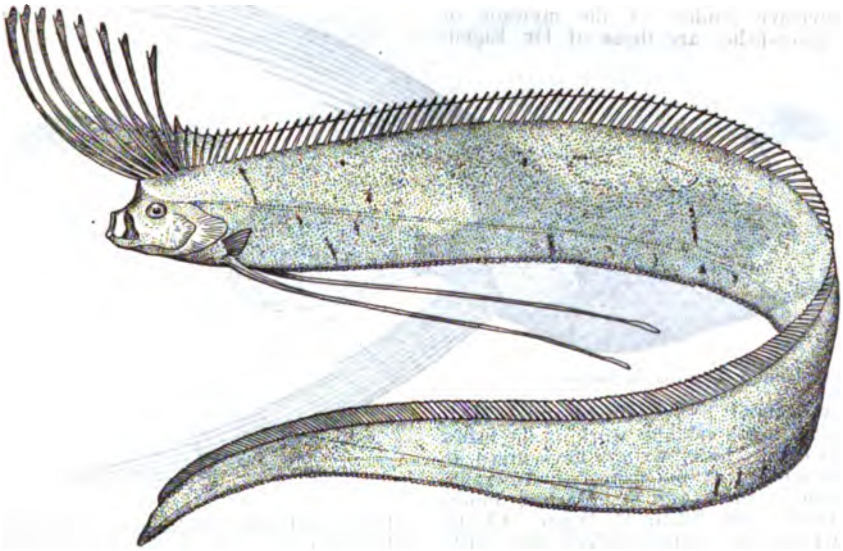
History of Systematic Ichthyology.— The title of «Father of Ichthyology» is justly given to Petrus Artedi, a Swede, associate and intimate friend of Linnæus. Artedi was the first to recognize the meaning of genus and species in ichthyology, and to supply the outlines of a rational classification. After Artedi's untimely death (by drowning in a canal in Holland), Linnæus edited his manuscripts, publishing them in 1738, in five parts, as follows: (1) Ichthyological biography; (2) Ichthyological philosophy; (3) Genera of fishes, involving a complete classification of the forms he knew, his genera corresponding to the groups now called families; (4) Synonymy of all species recorded by authors, and (5) Description of all the species actually examined by Artedi. Of true fishes (exclusive of whales) 228 species are recorded by Artedi — a small portion of the 12,000 species now actually known (1903).

But the work of Artedi is masterly in its method and shows a stronger touch than that of any of his successors in ichthyology until the time of Cuvier. In the 'Systema Naturæ' Linnæus did little more for fishes than to substitute binomial names for the descriptive phrases of Artedi.

After Artedi, and independently, the group of fishes was arranged in genera by Klein and by Gronow, both writers of ability, but neither with the genus for taxonomy shown by Artedi.

With the 'Règne Animal' (1817–28) of Cuvier, a new era in zoology began. In this epoch-making work the «Animal kingdom,» as the title indicates, was «arranged according to its organization.» Comparative structure found its reflection in the schemes of classification. The application of the principles of morphology was carried out in detail with the fishes in the great 'Histoire Naturelle des Poissons' (1828–49) of Georges Dagobert Cuvier and Achille Valenciennes, long the most valuable general work on fishes. The only general work on fishes since Cuvier and Valenciennes is the monumental 'Catalogue of the Fishes of the British Museum' (1859–70) by Dr. Albert Günther. In this work 6,843 species are described and 1,682 doubtful species are mentioned in foot-notes, the number of species known in 1870 being estimated at 9,000. Since that date about 3,000 have been described, the number of living species at present, according to an enumeration made by Dr. Boulenger, being about 12,000. The number of fossil species known may be estimated at 3,000 to 4,000.

The systematic arrangement of Cuvier was extended and modified by Louis Agassiz to include the multitude of fossil forms made known in his ‘Poissons Fossils.’ Still more important corrections and changes in the general scheme of classification were suggested by Johannes Müller, the greatest comparative anatomist of the 19th century. Other valuable contributions to taxonomy have been made by Dr. Günther, Dr. Edward Drinker Cope, and especially by Dr. Theodore Gill, a critical writer, doubtless the first taxonomist of the age, and whose views have been accepted in substance if not in name as representing our best present knowledge of the origin and relationship of forms among the vertebrate animals. The contributions of Geoffroy Saint-Hilaire, Pieter van Bleeker, Carl Gegenbaur, Ramsay H. Traquair, George Albert Boulenger, Louis Dollo, Bashford Dean, Karl Zittel, Arthur Smith Woodward, C. Tate Regan, G. Brown Goode, Samuel Garman, Charles H. Gilbert and Barton W. Evermann to the systematic arrangement of the higher groups of fishes have also been of great value.



A Ribbon-fish or Oarfish (*Regalecus*).

In modern times the students of systematic ichthyology have been very numerous. The local faunal work in various nations has been very extensive. In Great Britain we may note Parnell's ‘Natural History of the Fishes of the Firth of Forth’ (1838); William Yarrell's ‘History of British Fishes’ (1859); the earlier histories of British fishes by Edward Donovan and by William Turton, and the works of Jonathan Couch (1862), and Dr. Francis Day (1888), possessing similar titles. H. G. Seelye has also a useful ‘Synopsis of the Fresh-water Fishes of Europe.’ William Swainson studied the fishes of Sicily, W. Thompson those of Ireland and Rev. Richard T. Lowe and J. Y. Johnson have done excellent work on the fishes of Madeira.

In Germany and Austria the chief local works have been those of Heckel and Kner on the fresh-water fishes of Austria (1858), and C. Th. von Siebold on the fresh-water fishes of central Europe (1863). The two memoirs of Eduard Rüppell on the fishes of the Red Sea and neighboring parts of Africa, ‘Atlas zu der Reise im nördlichen Afrika’ (1828) and ‘Neue Wirbelthiere’ (1837), rank with the very best of descriptive work.

In Italy, Charles Lucien Bonaparte, Prince of Canino, has published an elaborate ‘Fauna Italica’ (1838), and numerous minor papers. O. G. Costa published (about 1850) a ‘Fauna of Naples.’

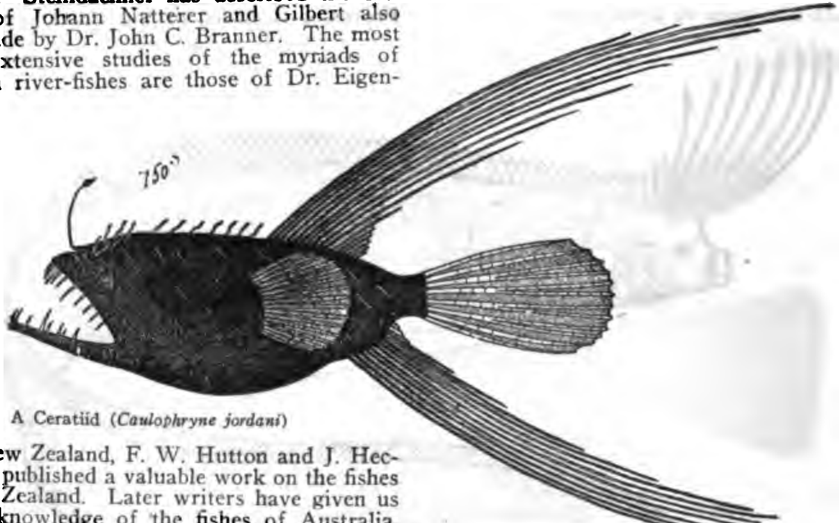
In France, the fresh-water fishes are the subject of works by Emile Blanchard (1866) and Emile Moreau. Léon Vaillant has written on various groups of fishes. The ‘Mission Scientifique au Mexique,’ by Vaillant and F. Bocourt, is a most valuable contribution to our knowledge of the fishes of Mexico. In this field our knowledge has been much extended by the work of Seth E. Meek and of Mr. Regan.

In Holland the chief great works have been those of Schlegel and Pieter van Bleeker. Professor Schlegel, of the University of Leyden, described in ‘The Fauna of Japonica’ the fishes collected about Nagasaki in Japan by Ph. Fr. de Siebold and Bürger.

Pieter van Bleeker (1819–78), a surgeon in the Dutch East Indies, is the most voluminous writer in ichthyology. His chief work is the ‘Atlas Ichthyologique des Indes Orientales Néerlandaises,’ illustrated by colored plates. The writings of Dr. Bleeker constitute the chief source of our knowledge of the fauna of the East Indies. Dr. Van Lidth de Jeude, of the University of Leyden, is the author of a few descriptive papers on fishes.

The fish fauna of Cuba has been the lifelong study of Dr. Felipe Poey y Aloy (1799–1891), a pupil of Cuvier, for a half century or more the honored professor of zoology in the University of Havana. Of his many useful papers, the most extensive are his ‘Memorias sobre la Historia Natural de la Isla de Cuba,’ followed by a ‘Repertorio’ and an ‘Enumeratio’ on the same subject. Before Poey, Guichenot of Paris had written on the fishes collected in Cuba by Ramon de la Sagra. Philip H. Gosse (1810–88) wrote on the fishes of Jamaica. Much earlier, Robert Herrmann Schomburgk (1804–65) wrote on the fishes of British Guiana. Other papers on the Caribbean fishes were contributed by Johannes Müller and F. H. Troschel, and by Richard Hill and J. Hancock.

Besides the work in South America of Marcgrave, Agassiz, Reinhardt, Lütken, Steindachner, Jenyns, Boulenger and others already named, we may note the local studies of Dr. Carlos Berg in Argentina, Dr. R. A. Philippi in Chile, and special records of Humboldt, Garman, J. F. Abbott and others in recent times. Carl H. Eigenmann and also Jordan and Eigenmann have studied the great collections made in Brazil by Agassiz, the work of Dr. Eigenmann now comprising most of our detailed knowledge of the fish-fauna of equatorial America. Steindachner has described the collection of Johann Natterer and Gilbert also those made by Dr. John C. Branner. The most recent extensive studies of the myriads of Brazilian river-fishes are those of Dr. Eigenmann.



A Ceratiid (*Caulophryne jordani*)

In New Zealand, F. W. Hutton and J. Hector have published a valuable work on the fishes of New Zealand. Later writers have given us a good knowledge of the fishes of Australia. Notable among them are W. Maclay, James Douglas Ogilby and Edgar R. Waite. Clarke has also written on 'Fishes of New Zealand.'

The most valuable work on the fishes of Hindustan is the elaborate treatise on the 'Fishes of India,' by Francis Day.

The most recent as well as the most extensive studies of the fishes of Japan were made in 1900 by the present writer and his associates, John Otterbein Snyder and Shigeho Tanaka.

The scanty pre-Cuvieran work on the fishes of North America has already been noticed. Contemporary with the early work of Cuvier is the worthy attempt of Prof. Samuel Latham Mitchill (1764–1831) to record in systematic fashion the fishes of New York. Soon-after followed the admirable work of Charles Alexandre Le Sueur (1780–1840), artist and naturalist, who was the first to study the fishes of the Great Lakes and the basin of Ohio. Constantine Samuel Rafinesque (1784–1842), the third of this remarkable but very dissimilar trio, published numerous papers descriptive of the species he had seen or heard of in his various botanical rambles. This culminated in his elaborate but untrustworthy 'Ichthyologia Ohiensis.' The fishes of Ohio received later a far more conscientious, though less brilliant, treatment at the hands of Dr. Jared Potter Kirtland (1793–1877), an eminent physician of Cleveland, Ohio. In 1842 the amiable and scholarly James Ellsworth Dekay (1799–1851) published his detailed report on the New York fauna, and a little earlier (1836) in the 'Fauna Boreali-Americana' Sir John Richardson (1787–1865) gave a most valuable and accurate account of the fishes of the Great Lakes and Canada. Almost simultaneously, Rev. Zadock Thompson (1796–1856) gave a catalogue of the fishes of Vermont, and David Humphreys Storer (1804–91) began his work on the fishes of Massachusetts, finally expanded into a 'Synopsis of the Fishes of North America' (1846) and a 'History of the Fishes of Massachusetts' (1867). Dr. John Edwards Holbrook (1794–1871), of Charleston, published (1860) his invaluable record of the fishes of South Carolina. The monograph on Lake Superior (1850), and other publications of Louis Agassiz (1807–73) are well known. One of the first of Agassiz's students was Charles Girard (1822-95), who came with him from Switzerland, and in association with Spencer Fullerton Baird (1823–87) described the fishes from the United States Pacific Railway Surveys (1858) and the United States and Mexican Boundary Surveys (1859).

Most eminent among the students and assistants of Professor Baird was his successor, George Brown Goode (1851–99), whose greatest work, 'Oceanic Ichthyology,' published in collaboration with Dr. Tarleton Hoffman Bean, was barely finished at the time of his death. The work of Theodore Nicholas Gill and Edward Drinker Cope has been already noticed.

The present writer began a systematic 'Catalogue of the Fishes of North America' in 1875, in association with his gifted friend, Herbert Edson Copeland (1849–76), whose sudden death, after a few excellent pieces of work, cut short the undertaking. Later, Charles Henry Gilbert (1860——), originally a student of Professor Copeland, took up the work, and in 1883 a 'Synopsis of the Fishes of North America' was completed by Jordan and Gilbert. Dr.

Gilbert has since been engaged in studies of the fishes of Panama, Alaska and other regions, and the second and enlarged edition of the 'Synopsis' was completed in 1898, as the 'Fishes of North and Middle America,' in collaboration with another of the writer's students, Dr. Barton Warren Evermann.

As students of the extinct fishes, following the epoch-making 'Poissons Fossiles' of Louis Agassiz, some of the notable names are those of Pander, Asmuss, Heckel, Hugh Miller, Traquair and Eastman. An indispensable 'Handbuch der Palæontologie' is that of Karl A. Zittel, translated by Charles R. Eastman. The most valuable general work is the 'Catalogue of the Fossil Fishes in the British Museum' in four volumes, by Dr. Arthur Smith Woodward, a worthy companion of Günther's Catalogue of living fishes.

Atlantic Bat-fish (*Malthe vespertilio*).

In America Dr. John Strong Newberry and Prof. Edward W. Claypole have studied the fossil fishes of Ohio. Edward Drinker Cope and Dr. Joseph Leidy have written on the Eocene and Cretaceous fishes of the Rocky Mountains. Numerous recent papers of importance have been published by Dr. Bashford Dean, of Columbia University, Dr. Charles R. Eastman, of Harvard, and Dr. Oliver Perry Hay, of New York. Other important records are due to Orestes St. John, A. H. Worthen, Charles D. Walcott, J. F. Whiteaves, S. W. Williston and the Redfields, father and son.

Besides all this there has risen, especially in the United States, Great Britain, Norway, Canada and Australia, a vast literature of commercial fisheries, fish culture and angling, the chief workers in which fields we may not here enumerate even by name. See Fish; Fishes, Geographical Distribution of.

David Starr Jordan,
Chancellor Emeritus, Leland Stanford Junior University.

ICHTHYOPSIDA, ik-thĭ-ŏp'sĭ-dạ. See Herpetology.

ICHTHYOPTERYGIA. See Ichthyosauria.

ICHTHYORNIS, ik-thĭ-ôr'nĭs, a genus of fossil carinate birds constituting an order *Ichthyornithes* and family *Ichthyornithidæ*. They were about the size of, and presumably had much the habits and appearance of, rather large gulls, but they had extremely large heads, and both mandibles of the long pointed beak were studded with sharp, backward pointing, snake-like teeth, each set in a distinct socket. These sea-birds fished in the great inland sea which during the Cretaceous Age covered so much of the present western half of the United States, and the remains of two species and of some allied forms, as *Aptornis*, are found in western Kansas, but they became extinct at the end of the period. See Birds, Fossil.

ICHTHYOSAURIA, ĭk'thĭ-ō-sā'rĭ'a, **ICHTHYOPTERYGIA,** or **FISH-LIZARDS,** an order of reptiles, embracing primitive marine forms with a fish-like body, long head and tail, and no distinct neck, whose remains are found exclusively in the Mesozoic, and most plentifully in the Lias. Remains of these lizards are sparse in the middle Jura, but numerous in the upper Jura of southern and western Europe; and are found in the Cretaceous of Europe, the East Indies, Australia, New Zealand and Chile. They varied in length from 3 to about 30 feet, and, as shown by their numerous coprolites (q.v.), fed upon fishes and cephalopods (squids). "The members of this order," remarks Zittel, "differ conspicuously from all living reptiles and are distinguished chiefly by their fish-like form of body, paddle-shaped limbs with numerous oval or polygonal phalanges, large head with elongated rostrum, short amphicœlous vertebræ, and naked integument." They had no dermal armament like crocodiles, but the snout was prolonged, narrow like that of a gavial or a dolphin, the teeth were acutely conical, crocodile-like and thickly set in a groove without separate sockets; as many as 400 have been counted in a single mouth. The eyes were surrounded by a circle of wedge-shaped sclerotic plates. That they breathed air is plain from the absence of branchial arches, the shape of the hyoid bones, and other evidences of pulmonary respiration; and their viviparous habit is demonstrated by several well-preserved skeletons embracing embryonic remains in the abdominal cavity,— as many as seven young in one case. As regards external form and adaptation to a marine existence, the ichthyosaurus "depart as widely from other reptiles as whales do from land mammals, and occupy as isolated a position." Their composite character is most puzzling to the phylogenist, and nothing is certainly known as to their origin or descent, except that they certainly were modified from terrestrial ancestors. The only family is *Ichthyosauridæ*, which existed from the Lias to the Cretaceous periods, and contains the small-sized and primitive genus *Mixosaurus*, the typical and exclusively Old World genus *Ichthyosaurus*, *Baptanodon* (q.v.), and *Shastasaurus*, the last two being American in their distribution and recovered from the upper Jura and Trias rocks of Wyoming, Nevada and northern California. Consult Zittel-Eastmann, 'Text-book of Palæontology,' (Vol. II, New York 1902); Gadow, 'Amphibia and Reptiles' (London 1901).

ICHTHYOSIS, ĭk-thĭ-ō'sĭs, a congenital, chronic disease of the skin characterized by dryness, harshness, increased thickness, atrophy of the sebaceous glands, resulting in a scaly appearance. It usually affects young children. It is little understood, but a diet of fresh, juicy vegetables is recommended.

ICHTHYS, ĭk'thĭs, a symbol used by the early Christians. It was derived by taking the first letters of the common title of Christ «Jesus Christ, the Son of God, the Saviour,» in Greek ('Ι/*ησοῦς χ/ριστὸς* Θ/*εοῦ* Υ/*ἰὸς* Σ/*ωτήρ*, which spells *Ιχθγ*Σ, the Greek word for fish. The acrostic and the figure of the fish thus became the symbol of Christ.

ICON BASILIKE. See EIKON BASILIKE.

ICONOCLASTS, ī-kŏn'ō-klăsts (image-breakers), that Christian party in the Church of the 8th and 9th centuries who would not tolerate images in the churches or places of worship. The Byzantine emperor, Leo the Isaurian, issued an edict in 726 ordering the people to abstain entirely from paying religious reverence to sacred images and a second edict soon after ordered the destruction of the images. This order occasioned commotions, first in the islands of the Archipelago; and as the Popes Gregory II and III, as well as Germanus, the patriarch of Constantinople, declared the veneration of sacred images to be in consonance with the Church's doctrine and constant practice, and the Emperor Leo refused to recall his edict on their command, they excommunicated him, and his subjects in Italy threw off their allegiance. Thence arose two parties, the Iconoolatræ (image worshippers) and the Iconoclasts. Leo's son and successor, Constantine Copronymus, held the same views as his father. He convened a council at Constantinople (754), in which the use as well as the worship of images was condemned. Constantine's son, Leo IV, who ascended the throne 775, followed the same course, but proceeded with more clemency and moderation. On the death of Leo IV, in 780, he was succeeded by his son, Constantine, under the guardianship of Irene, mother of the latter, and widow of Leo. Irene favored the orthodox party, and on attaining this position of authority, openly avowed her sentiments, and summoned a council to be held in 787, under her protection at Nicæa (Nice) in Bithynia, to pass upon the question at issue. This council condemned the Iconoclasts. Among the Greeks the controversy concerning images broke out anew after the banishment of Irene (802), and lasted about half a century. Her successor, Nicephorus, did not, indeed, remove the images from the churches, but he forbade the adherents of the images from persecuting their adversaries. Finally the Empress Theodora, by a council held at Constantinople (842), restored the worship of images among the Greeks, which was confirmed by a second council, held 869–70, in the same place. Consult 'Seances Academy des Inscript' (May 1903); Tougard, 'La Persecution Iconoclaste' (1897).

ICONOSTASIS, ī'kō-nŏs'tă-sĭs, in a Greek church, the screen dividing the sanctuary from the church proper. This is usually ornamented with pictures of Christ, the Virgin and saints. The screen has three doors generally, whose curtains are dropped while Mass is being celebrated.

ICTERIDÆ, ĭk-tĕr'ĭ-dē, a family of birds, the American orioles, or hangnests, and blackbirds (qq.v.).

ICTINUS, ĭk'tĭ-nŭz, a Greek architect, who flourished at the time of Pericles. He designed the Parthenon at Athens, the hall for the mysteries at Eleusis and the temple of Apollo Epicurius at Bassæ near Phigalia. Little is known of his life.

ICY CAPE, Alaska, a promontory so named on account of the immense masses of ice by which it is usually surrounded. On the north coast it projects into the Arctic Ocean west of the Otakah River, about midway between Capes Lisburne and Barrow. It was discovered by Cook in 1778, and was the farthest point that he reached north of Bering Strait.

IDA, (1) Asia Minor, the classical name of Kaz-Dagh, a mountain range, 30 miles southeast of the plain of Troy, with its highest peak, Gargaron (4,650 feet), near the head of the Gulf of Adramyti. In mythology it is famous as the range where Ganymede was stolen; where Paris pronounced judgment on the beauty of the rival goddesses and where the celestials stationed themselves to witness the battles for Troy on the nether plain. (2) The classical name also of a mountain (now Psiloriti) in Crete (q.v.), the loftiest (7,500 feet) of the range which traverses the island. The most celebrated legends connected with it are those relating to the infancy of Zeus.

IDA GROVE, Iowa, a town, the capital of Ida County, 28 miles north of Denison, on the Maple River, and on the Chicago and Northwestern Railroad. Farming and stock-raising are carried on largely in the vicinity, and the town has flour mills, grain elevators and manufactures of machinery, harness, brooms and bricks. Among municipalized installations are a heating and an electric-lighting plant. Pop. 2,090.

IDAHO (Indian, «Mountain Gem»), one of the Northwestern States of the United States. Its extreme length from north to south along the western border is 485 miles. The width varies from 50 miles in the northern part where it borders on the Dominion of Canada to about 300 miles in the south. The total area is approximately 84,000 square miles of which about 534 is water surface. The capital is Boise.

Topography.— Idaho is widely diversified topographically, having many hills and mountains, interspersed with fertile valleys, rugged canyons, mountain gorges, wide upland meadows and wooded parks, broad plateaus, rolling prairies, sage brush plains, great rivers with cascades and cataracts, beautiful lakes with jetting bays, studded with great pines and Douglas fir. The Cabinet, Cœur d'Alene and Bitter Root mountains, principal spurs of the great Rockies, form the eastern boundary separating Idaho and Montana. From these mountain chains spurs are sent out west and southwest through nearly every part of the State to the great plains of the Snake River Basin which extends in crescent shape across

IDAHO.

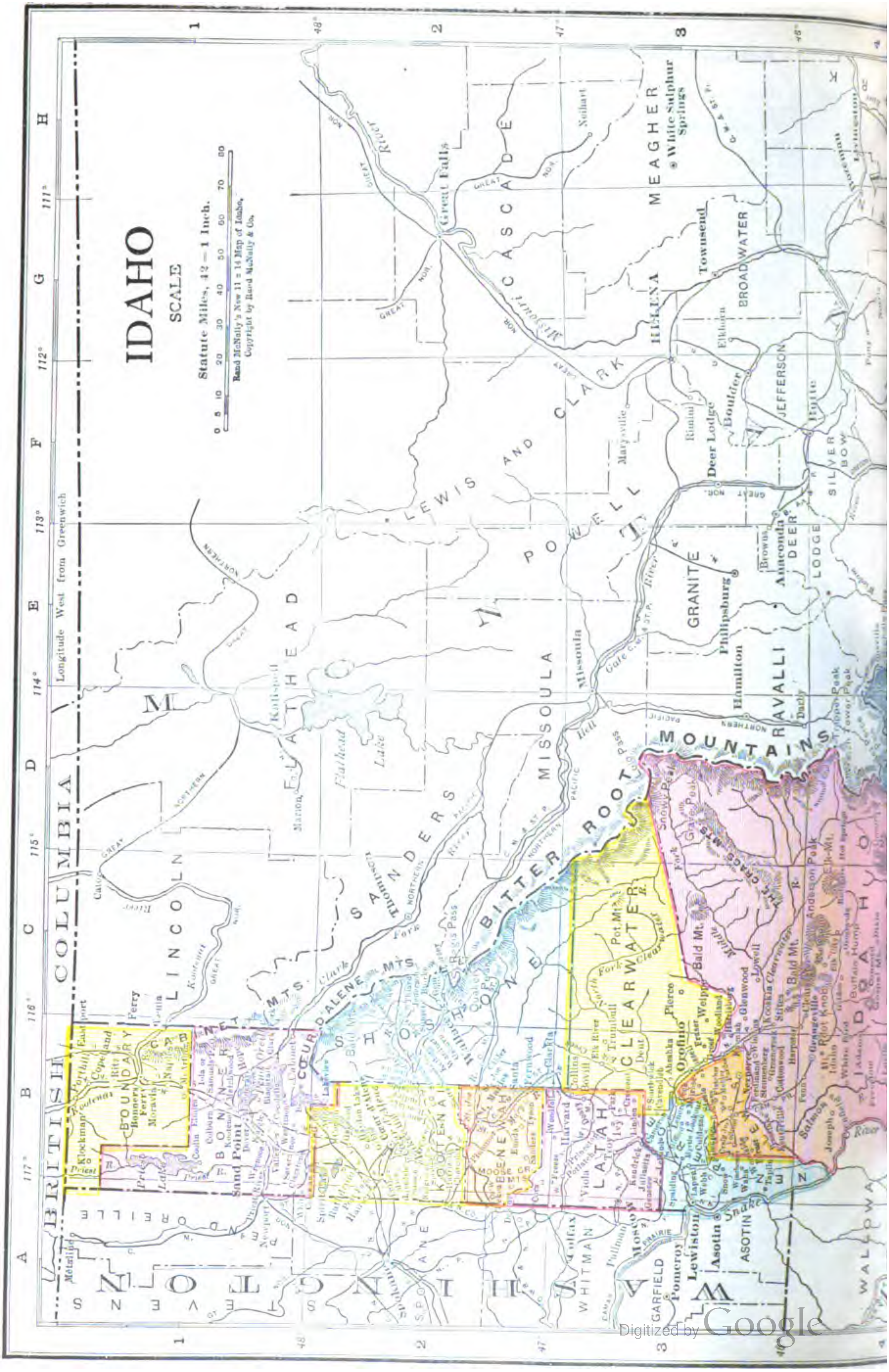
Estimated population, 428,586

COUNTIES

Pop.		
29,088	Ada	B 6
	Adams (Pop. incl. in Washington Co.)	B 4
19,242	Bannock	G 7
7,729	Bear Lake	G 7
	Benewah (Pop. incl. in Kootenai Co.)	B 2
23,306	Bingham	F 6
8,387	Blaine	D 6
5,250	Boise	C 5
13,588	Bonner	B 1
.....	Bonneville (Pop. incl. in Bingham Co.)	G 6
.....	Boundary (Pop. incl. in Bonner Co.)	B 1
.....	Butte (Pop. incl. in Blaine, Jefferson and Bingham. Cos.)	E 6
.....	Camas (Pop. incl. in Blaine Co.)	D 6
25,323	Canyon	B 6
7,197	Cassia	E 7
.....	Clearwater (Pop. incl. in Nez Perce Co.)	C 3
3,001	Custer	D 5
4,785	Elmore	C 6
.....	Franklin (Pop. incl. in Oneida Co.)	G 7
..,606	Fremont	F 5
...	Gem (Pop. incl. in Canyon and Boise Cos.)	B 5
.....	Gooding (Pop. incl. in Lincoln Co.)	D 7
12,384	Idaho	C 4
.....	Jefferson (Pop. incl. in Fremont Co.)	F 6
22,747	Kootenai	B 2
18,818	Latah	B 3
4,786	Lemhi	D 4
.....	Lewis (Pop. incl. in Nez Peroe Co.)	B 3
12,676	Lincoln	D 7
.....	Madison (Pop. incl. in Fremont Co.)	G 6
.....	Minidoka (Pop. incl. in Lincoln Co.)	E 7
24,860	Nez Perce	B 3
15,170	Oneida	F 7
4,044	Owyhee	C 7
.....	Payette (Pop. incl. in Canyon Co.)	B 6
.....	Power (Pop. incl. in Oneida Co.)	F 7
13,963	Shoshone	C 2
.....	Teton (Pop. incl. in Madison Co.)	G 6
13,543	Twin Falls	D 7
.....	Valley (Pop. incl. in Idaho and Boise Co.)	C 5
11,101	Washington	B 5

Incorporated Cities, Towns, and Villages

392	Albion	E 7
953	American Falls	F 7
214	Ammon, Bingham	G 6
322	Aroo	E 6
502	Ashton	G 5
281	Athol	B 2
200	Basalt	F 6
702	Bellevue	D 6
2,202	Blackfoot	F 6
539	Bloomington, Bear Lake	G 7
33,846	Boise	B 6
1,071	Bonners Ferry	B 1
639	Buhl	D 7
3,543	Caldwell	B 6
349	Cambridge	B 5
130	Centerville	C 6
338	Challis	D 5
7,291	Coeur d'Alene	B 2
555	Cottonwood	B 3
312	Council	B 5
436	Culdesao	B 3
1,351	Emmett	B 6
214	Filer	D 7
534	Franklin	G 7
742	Genesee	B 3
410	Georgetown	G 7
153	Gifford	B 3
800	Glenns Ferry	C 6
1,444	Gooding	D 7
1,534	Grangeville	C 4
1,231	Hailey	D 6
932	Harrison	B 2
215	Hope	B 1
262	Idaho City	C 6
4,827	Idaho Falls	G 6
209	Ilo	B 3
353	Iona	G 6
970	Jerome	D 7
414	Juliaetta	B 3
324	Kamiah	B 3
1,273	Kellogg	B 2
543	Kendrick	B 3
111	Kippen	B 3
301	Kooskia	C 3
6,043	Lewiston	A 3
346	Lewisville, Fremont	G 5
321	McCammon	F 7
638	Mackay	E 6
1,303	Malad City	F 7
298	Marysville	G 5
294	Menan	G 6
619	Meridian	B 6
1,924	Montpelier	G 6
3,670	Moscow	A 3
1,411	Mountain Home	C 6
1,667	Mullan	C 2
4,205	Nampa	B 6
274	New Plymouth	B 5
599	Nez Perce	B 3
911	Oakley	E 7
384	Orofino	B 3
1,038	Paris	G 7
432	Parker	G 6
338	Parma	B 6
1,948	Payette	B 5
123	Pearl	B 6
236	Peck	B 3
187	Placerville	B 6
12,293	Pocatello	F 7
658	Post Falls	B 2
2,110	Preston	G 7
248	Priest River	B 1
725	Rathdrum	B 2
1,893	Rexburg	G 6
158	Richfield	D 6
555	Rigby	G 6
192	Roberts	F 6
297	Rupert	E 7
1,238	St. Anthony	G 6
869	St. Maries	B 2
1,434	Salmon	D 4
366	Samaria	F 7
2,993	Sandpoint	B 1
537	Shelley	G 6
1,155	Shoshone	D 7
501	Soda Springs	G 7
266	Soldier	D 6
885	South Boise, Ada	B 6
907	Spirit Lake	B 2
300	Stites	C 3
391	Sugar	G 6
543	Troy	B 3
5,258	Twin Falls	D 7
279	Vanwyck	B 5
332	Vollmer	B 3
3,000	Wallace	B 2
1,369	Wardner	B 2
2,600	Weiser	B 5
482	Wendell	D 7
398	Weston	F 7


IDAHO
SCALE
Statute Miles, 42 = 1 Inch.
0 5 10 20 30 40 50 60 70 80
Rand McNally's New 11 x 14 Map of Idaho.
Copyright by Rand McNally & Co.
Longitude West from Greenwich
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3
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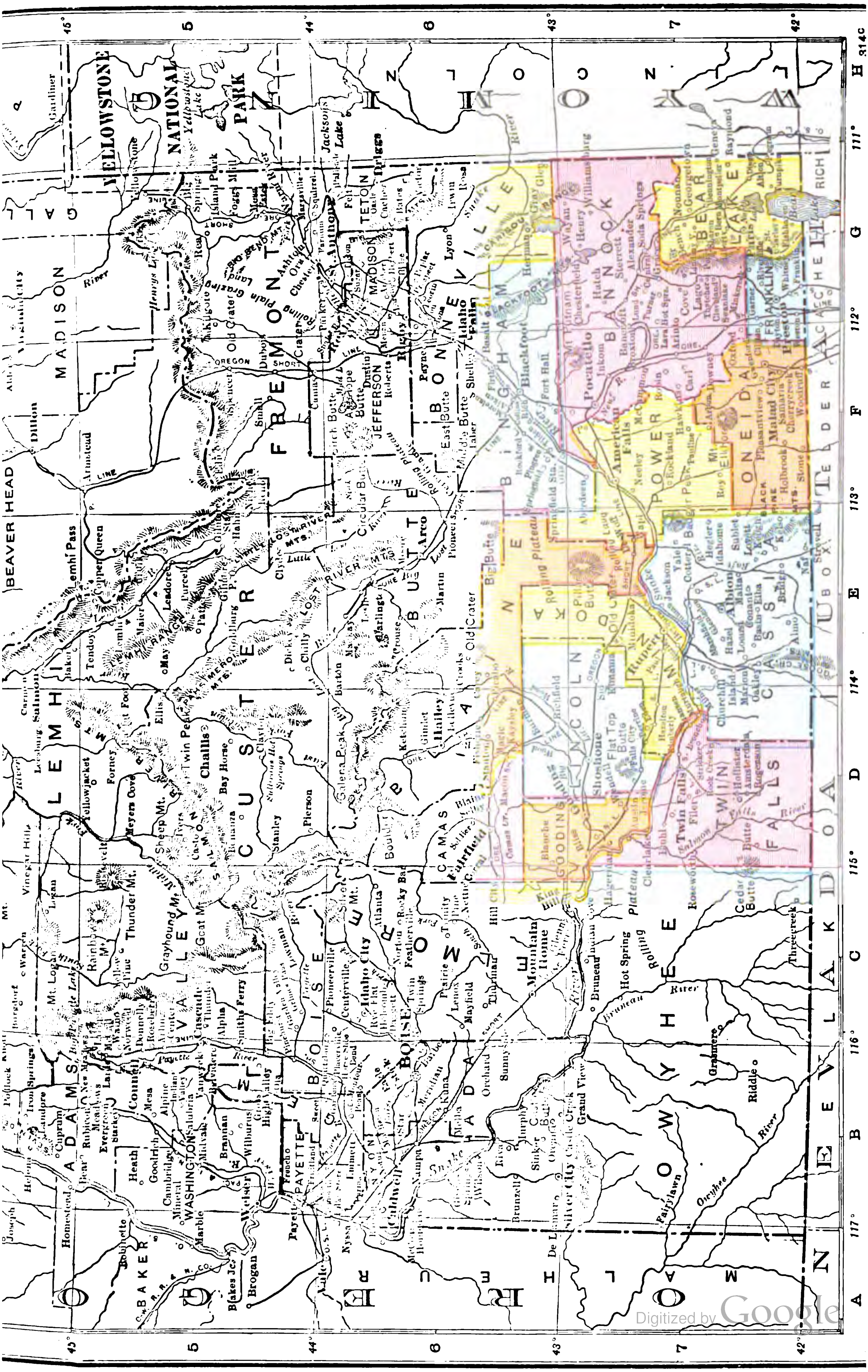
BRITISH COLUMBIA
BOUNDARY
BONNER
KOOTENAI
BENEWAH
LATAH
CLEARWATER
NEZ PERCE
LEWIS
IDAHO
SHOSHONE
LINCOLN
FLATHEAD
SANDERS
MISSOULA
LEWIS AND CLARK
POWELL
GRANITE
RAVALLI
DEER LODGE
SILVER BOW
JEFFERSON
BROADWATER
MEAGHER
CASCADE
STEVENS
PEND OREILLE
SPOKANE
WHITMAN
GARFIELD
ASOTIN
WALLOWA
BITTER ROOT MOUNTAINS
COEUR D'ALENE MTS.
Great Falls
Helena
Butte
Anaconda
Missoula
Deer Lodge
Philipsburg
Hamilton
Kalispell
Flathead Lake
White Sulphur Springs
Townsend
Boulder
Marysville
Neihart
Thompson
Sand Point
Bonners Ferry
Coeur d'Alene
Moscow
Lewiston
Pullman
Colfax
Spokane
Pomeroy
Asotin
Orofino
Pierce
Grangeville
Salmon River
Snake River
Clearwater R.
Missouri River
Clark Fork
Kootenai River
Priest Lake
Pend Oreille Lake
Lolo Pass
Trapper Peak
Bald Mt.
Pot Mt.
Elk Mt.
Anderson Peak
Buffalo Hump
GREAT NORTHERN
NORTHERN PACIFIC
C. M. & ST. P.


YELLOWSTONE NATIONAL PARK
MONTANA
WYOMING
OREGON
NEVADA
UTAH
BEAVER HEAD
MADISON
GALLATIN
LEMHI
CUSTER
FREMONT
MADISON
TETON
JEFFERSON
BONNEVILLE
BINGHAM
BUTTE
BLAINE
CAMAS
ELMORE
BOISE
VALLEY
ADAMS
WASHINGTON
PAYETTE
CANYON
ADA
OWYHEE
GOODING
LINCOLN
JEROME
MINIDOKA
CASSIA
TWIN FALLS
POWER
BANNOCK
ONEIDA
FRANKLIN
BEAR LAKE
BOX ELDER
CACHE
RICH
BAKER
Boise
Pocatello
Idaho Falls
Twin Falls
Blackfoot
Challis
Salmon
Hailey
Mountain Home
Shoshone
Rupert
American Falls
Malad City
Preston
Paris
Weiser
Caldwell
Silver City
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the southern part from east to west and forms nearly half the west central boundary separating Idaho from the States of Oregon and Washington. The Boise, Payette, Salmon and Clearwater rivers, all affluents of the Snake, drain the central part of the State. The Spokane, Pend d'Oreille and Kootenai rivers make outlet for the waters of the beautiful lakes of Cœur d'Alene, Pend d'Oreille, Kaniksu and Spirit Lake, all in the extreme northern part. A small portion of the southeastern part is drained through the Bear River into Salt Lake. This river also forms an outlet for Bear Lake, a beautiful body of water about half of which lies in the extreme southeastern part and extends into Utah.

Climate.— Idaho extends through seven degrees of latitude. Its altitude ranges from about 700 feet to more than 12,000 feet. Its northern end lies within the path of the rain areas which pass eastward from the north Pacific Ocean while the southern portion lies well out of that path. As a result of these complex factors the climate is so diverse as to render description difficult and accurate graphic representation impracticable. The lower Snake, Salmon and Clearwater River valleys have a very pleasant and equable climate. The higher valleys have most agreeable summers with long winters and heavy snowfall. The temperature of Idaho is varied, ranging from 108 degrees above in summer to 45 degrees below zero in winter. The mean temperature is 56 degrees. The normal annual precipitation is about 17 inches, ranging from 37 inches in Shoshone County in the northern part of the State, to six inches in the southern section.

Soils.— The rock from which the soil of central and southern Idaho was derived is known as the Columbia River lava, or basalt. There were successive flows of this lava, as is demonstrated by intervening sedimentary deposits. Above the lava the soil is fine and of a dark color, while the subsoil, of equally fine texture, is always of dark yellow or brownish color without pebbles or sand grains. The soils on the older lavas are usually light colored and contain sand and fragments of rocks and minerals. In the region of the great intermountain plateau along the course of the Snake River the soils consist of the fine, silty loams, formed through the weathering of the rolling basaltic country at higher levels, or they consist of ash-like and silty loams of ancient lake beds within which volcanic ash was deposited to great depths. Wherever water is available for the irrigation of these lands they have proven wonderfully fertile for the production of general and special crops. On the basaltic uplands heavy yields of grain and vegetables are obtained without irrigation. The soil of the northern part of the State is sandy and of a clayey loam less fertile yet it produces good crops without irrigation.

Geology.—There are many unusual geological phenomena in Idaho. The "City of Rocks" in Cassia County is as strange as, and but little less magnificent in scale than, the Garden of the Gods in Colorado. A thousand homes in Boise, the capital city, and the great Natatorium are heated by natural hot water from springs. Some of the cities obtain their summer water from springs at almost freezing temperature; in winter they obtain their water from other springs at 78° F. Near Richfield in Lincoln County is an ice cave in the lava beds with an ice dome that thaws out in winter and freezes in summer. There are many farms upon which cellars have been dug and deep wells have been bored for domestic water from which come streams of very cold air that is used for refrigerator purposes. There are hot mineral springs on the upper Salmon and Hood rivers — many along the course of the Snake River, and in southern Bannock County there are soda and other mineral springs noted for their medicinal properties. The magnificent cataracts of the Snake River are not surpassed in grandeur in the United States. The Shoshone Falls are 46 feet higher than those of Niagara. In central Idaho there are a number of streams that are "lost"— that, crystalline up to the last, sink away into the desert and disappear. In the very tops of some of the highest mountains are beautiful fresh water lakes fringed with tall pines and fir. Great lava planes extend along the Snake River Basin in width from 10 to 60 miles. These are of relatively recent overflow as evidenced by the numerous geysers and hot springs. They are rich in various fossils.

Agriculture.— There are considerably over 6,000,000 acres of land in Idaho under cultivation. There are numerous areas of irrigated and dry farm land on the alluvial bottoms and upon the bench lands of the small and large valleys included within the Rocky Mountain portion of the State. In Idaho, agriculture may be considered under three separate divisions, namely: humid farming, dry farming and irrigated farming. The humid section comprises the northern part of the State, where 67 per cent of the crop is wheat. Great areas of logged-off lands are now being put under cultivation and are specially adapted to the growing of clover. The chief crop in the dry-farming region, the southeastern part, is wheat raised by intensive cultivation. By far the greater proportion of the agricultural land, however, is found in the great intermountain plateau along the course of the Snake River where the largest irrigation systems in the country are maintained. These embrace 5,003,833 acres with canals aggregating 10,491 miles in length, and constructed at a cost of more than $90,000,000. These canals are assured an abundance of water by great dam and reservoir systems, among which are some of the largest and best in the world. The Jackson Lake reservoir on the head waters of the south fork of Snake River is one of the largest in the United States. The Arrowrock dam, storing water for irrigating 240,000 acres of land, is the highest dam in the world. The average yield of wheat per acre here is 26.6 bushels; of oats, 40.6 bushels. Idaho produces more alfalfa than any other State in the Union of equal acreage, the yield for 1917 being approximately 1,500,000 tons. An average yield of nearly three tons per acre is obtained. Idaho has about 140,000 acres of orchard. Her apples have won some of the greatest horticultural honors known. Idaho prunes are the finest in the world.

Stock Raising.— Idaho's stock growing has increased almost in keeping with its increased growth in agricultural development and population, chiefly due to available public range and wise Federal supervision of the extensive forest reserves on which hundreds of thousands of beef cattle and sheep graze during the summer season. There is ample winter provender on the great alfalfa farms of the Snake River valleys. In 1917 Idaho had nearly 500,000 beef cattle and 3,250,000 sheep. The dairy industry is growing rapidly. In 1918 there were about 140,000 milch cows in the State.

Forests.—Although lying partly within the arid belt, Idaho is well forested. Approximately 20,000,000 acres or 37 per cent of the total land area of the State is forested. Ample provision is made for the protection of the forested area by the fact that out of the total of 129,000,000,000 feet board measure, 71,000,000,000 feet or 55 per cent is included in the national forests, leaving 50,000,000,000 feet privately owned and 8,000,000,000 otherwise held by the government or State. In area about 90 per cent or 18,000,000 acres of the forest is under national control. Much of the area contains immature stands which have not yet reached the producing stage but will repay protection. The large white pine forests of northern Idaho are among the most valuable in the United States. Lumber production is increasing rapidly, the cut being mainly soft woods, western pine, white pine, larch and Douglas fir.

The following table gives the names of the national forests in Idaho, area, headquarters of supervisor and last proclamation date effective:

FOREST	Land area within national forest boundaries			Date of latest proclamation	Forest headquarters
	National forest land	Other lands	Total		
Boise	1,058,941	59,173	1,118,114	Dec. 24, 1910	Boise
Cache[1]	492,668	16,633	509,301	Oct. 9, 1917	Logan, Utah
Caribou[1]	681,540	30,090	711,630	April 18, 1914	Montpelier
Challis	1,259,237	10,753	1,269,990	May 21, 1914	Challis
Clearwater	785,103	122,743	907,846	July 1, 1911	Orofino
Cœur d'Alene	662,611	127,623	790,234	July 1, 1911	Cœur d'Alene
Idaho	1,193,439	15,841	1,209,280	Mar. 23, 1912	McCall
Kaniksu[1]	198,757	260,220	458,977	May 6, 1910	Newport, Wash.
Lemhi	1,095,924	4,638	1,100,562	May 19, 1913	Mackay
Minidoka[1]	509,536	21,584	531,120	Jan. 24, 1916	Burley
Nezperce	1,624,582	41,497	1,666,079	July 1, 1911	Grangeville
Payette	831,926	31,748	863,674	July 26, 1916	Emmett
Pend Oreille	676,014	198,724	874,738	May 6, 1910	Sandpoint
Saint Joe	493,925	481,743	975,668	April 24, 1917	Saint Maries
Salmon	1,621,707	21,653	1,643,360	May 19, 1913	Salmon
Sawtooth	1,203,387	16,743	1,220,130	May 19, 1913	Hailey
Selway	1,693,711	108,289	1,802,000	July 1, 1911	Kooskia
Targhee[1]	977,847	47,893	1,025,740	June 6, 1917	Saint Anthony
Weiser	562,609	98,291	660,900	July 1, 1911	Weiser
Total	17,623,464	1,715,879	19;339,343		

[1] A portion of these forests lie within adjoining States. The areas given are only for that part within Idaho.

Manufactures.— Manufacturing has more than kept pace with the growth of the State in population. Idaho has some of the largest lumber mills of the world. The Potlatch with a daily capacity of 750,000 board feet of lumber in a 24-hour run is considered the largest and the Boise-Payette with a capacity of 500,000 feet a close second. The State has an abundance of water power available for use in manufacturing. Idaho claims the establishment of the first commercial potato flour factory in the United States. It is located at Idaho Falls. Idaho's six beet sugar factories, located at Sugar City, Lincoln, Blackfoot, Burley, Twin Falls and Rupert, produced 102,000,000 pounds of sugar in 1917. Another factory was built at Shelley in 1917. Others are now in course of construction. The chief manufactured products are lumber, beet sugar, concrete, packed meats and flour. Large fruit evaporating plants were erected and operated at Meridian and Payette in 1917.

Mining.— Idaho is the largest lead-producing State in the Union. The total production of lead from Idaho's mines in 1917 aggregated 395,883,000 pounds. With an output of 12,496,017 ounces of silver in 1917, Idaho ranks a close second with the other principal producing States of the Union. The zinc mines of Idaho produced 96,123,000 pounds of this metal in 1917. The consolidated Interstate-Callahan mine of the Cœur d'Alene district ranks third among the individual producers of the United States. Copper mining is of less importance, there being a total yield of a little over 7,000,000 pounds in 1917. Gold placer mining was the original source of mining activity in Idaho. The State is credited with a total yield to date, since the original discoveries at Pierce City, of $200,000,000 in placer gold, which was mostly derived from mountain basins in the central granite batholith formations. The placer industry is now at a low ebb which is due to the practical ground exhaustion of the larger mines. Idaho produced, in 1917, 41,326 ounces of fine gold. Among the rare metals that are known to exist in Idaho are tungsten, molybdenite, nickel, tin, antimony and quicksilver. Idaho possesses the richest resources of phosphate rock in the world, located in the southeastern part of the State. Its resources of the commoner mineral substances in the form of fire-clays, Portland cement, etc., are practically inexhaustible.

Transportation.— There are 2,430 miles of steam and about 150 miles of electric roads in the State. From Lewiston, boats run on the Snake and Clearwater rivers, carrying freight from the inland through the Columbia River to the Pacific. Stages ply daily to nearly all parts of the State not accessible by railroads. On 1 Jan. 1917, Idaho had spent a total of $856,979 in general State funds on highways and bridges. The programs for expenditures for State highways alone during the years 1917 and 1918 amounted to $2,345,000. State highways connect all principal parts of Snake River Valley in the south and the chief centres of population and industry of the north. A north and south highway is now being constructed to connect the northern and southern parts of the State which have hitherto been separated by great mountain chains and river valleys almost impassable.

STATISTICS OF IDAHO MANUFACTURES — 1912.

KIND OF MANUFACTURE	Number of establishments	Capital invested	Number of proprietors and firm members	Number of employees		Total number persons engaged in industry	Total salaries and wages for year		Average number hours worked per day	Average number days worked per year	Total value of products, 1912
				Male	Female		Male employees	Female employees			
Saw and planing mill products [1]	274	$18,123,808	360	6,553	49	6,962	$4,391,000	$20,525	10	238	$11,346,000
Flour and grist mill products	57	2,244,848	58	292	......	350	306,016	....	9	295	2,994,848
Sugar manufactures	5	5,300,000	2	653	......	655	179,575	....	24	100	2,182,500
Butter and cheese [2]	36	756,000	81	180	36	297	132,558	16,146	9.5	299	1,768,129
Printing and publishing	143	1,382,810	271	475	80	826	489,428	45,077	9	312	1,730,689
Cars and repairs by railroads	5	468,328	......	960	......	960	696,409	....	8	307	1,366,408
Bakery and confectionery products [2]	84	348,816	111	166	102	379	150,356	50,667	10.5	333	774,507
Slaughtering and meat packing [3]	5	428,999	8	60	2	70	53,208	1,600	10	307	664,625
Brick and tile	36	800,137	40	429	......	469	139,425	....	8	100	487,985
Liquors, malt [4]	9	1,006,911	9	83	......	92	83,000	....	8	307	417,150
Foundries and machine shops	14	276,753	15	87	......	102	83,941	....	10	307	228,469
Fruit canning [2]	6	63,600	6	73	153	232	15,768	25,707	12	96	193,000
Tobacco manufactures	24	74,753	25	73	29	127	93,951	12,856	8	286	187,803
Ice, manufactured	9	424,341	18	30	......	48	25,200	....	10	280	145,863
Total	707	$31,700,104	1,004	10,114	451	11,569	$6,839,835	$172,578	......	......	$24,487,976

[1] Does not include detached planing mills doing custom work.
[2] Includes commercial plants only.
[3] Plants operating under government supervision.
[4] Since compilation of above statistics, manufacture of liquor has been prohibited.

Banking and Finance.— On 20 Nov. 1917 there were 137 State banks with total deposits of $44,663,884. The reserve of all State banks reporting for call on that date shows an average of 30 per cent. Individual deposits held subject to check in these banks was $30,728,763.97 Individual saving deposits was $2,965,802.95, averaging about $7 per capita.

For the two years ending 30 Sept. 1916 the receipts and disbursements were as follows:

Cash in hand, 1 Oct. 1914	$1,246,356
Receipts, 1914–16	6,119,406
Total	$7,445,762
Disbursements 1914–16	6,260,832
Balance in treasury, 30 Sept. 1916	$1,184,930

The revenues are derived from general tax levies, receipts from the department of the secretary of state, interests on funds and receipts from other departments. Disbursements are, of course, made to defray the expenses of State government and to maintain the various State institutions. On 30 Sept. 1916 the State bonded debt amounted to $2,227,750 and a sinking fund of $400,000. The assessed value of real and personal property for 1917 amounted to $444,857,675.

Education.— The Idaho system differs from all others in its complete unity of the school affairs of the State, from the primary grades to the university, which are under the supervision of one single State Board of Education. This board consists of five members appointed by the governor, and one ex-officio member, the State superintendent of public instruction. Three members act as a governing board for the six State educational institutions, including the university, the two State normal schools, the Idaho Technical Institute, the Industrial Training School and the State School for the Deaf and Blind. This same board exercises general supervision over the public elementary and high schools. The State Board of Education has the duty of assisting the legislature in every possible way in framing and enacting the educational laws, and it is the duty of the board, prior to each meeting of the State legislature, and in ample time for due consideration by said legislature, to prepare a financial budget setting forth the financial needs of all State educational institutions under its supervision and control.

Idaho spends annually on her public schools approximately $4,500,000. It has 147 public high schools and 11 private academies, 1,594 public school buildings and 3,636 teachers. There are two State normal schools — one located at Albion and one at Lewiston. An excellent State university is located at Moscow, embracing the following colleges: letters and science, agriculture, engineering, law, school of forestry, school of mines, extension division and experiment station. The Technical Institute is located at Pocatello and an industrial training school at Saint Anthony. The School for the Deaf and Blind is located at Gooding.

Charities and Corrections.— The State Penitentiary located at Boise, the State Insane Asylums located at Blackfoot and Orofino, an Institute for the Feeble-Minded at Nampa and the State Industrial School at Saint Anthony all own agricultural lands and cattle in connection, cultivated and cared for chiefly by the inmates of these institutions, making them almost, if not quite, self-supporting. The Orphans' Home at Boise and the School for the Deaf and Blind at Gooding is supported by State appropriations.

Militia.— The State of Idaho has no armories. The strength of the National Guard of Idaho in the Federal service, 1 Jan. 1917, was 56 officers and 1,073 men. This has been increased since the declaration of war with Germany.

Religion.— In religion Idaho is predominantly Latter-Day Saint, or Mormon, with Catholics, Methodist, Baptist, Presbyterian, Christian, etc., following in the order named.

Indians.— A total Indian population of 3,791, consisting of remnants of what were once five great tribes, reside now within three reservations in Idaho. Their number is fast decreasing and ere long the red man of Idaho, who not more than 40 years ago was held in continual fear by the white pioneer, will be known only in story. Yet the memory of the race will be everlasting, because of the many beautiful words that the white settler has adopted from the Indian language, and has given to the mountains and the valleys, the lakes and the streams, the counties, cities and towns. Vital statistics of the Indians of Idaho show a death rate that greatly exceeds the rate of birth. The Cœur d'Alene Reservation, comprising 104,077 acres, is located in Kootenai County. It is inhabited by 623 Cœur d'Alene and Spokane Indians. The office of the superintendent of the reservation is located at Tekoa, Wash. The Fort Hall Reservation in Bingham and Bannock counties, with headquarters at Fort Hall, Idaho, includes 454,239 acres of land. It is set apart for the Bannock and Shoshone Indians and for the Lemhi tribe, which was moved from the reservation in Lemhi County. There are 1,779 Indians on the Fort Hall Reservation. The Nez Percés at Fort Lapwai, near Lewiston, are considered the most highly civilized Indians in Idaho. The tribe numbers 1,389, all of whom have discarded their native attire and have adopted modern customs. There are 212,390 acres in the Fort Lapwai Reservation. Agriculture is the principal occupation followed by the Indians of Idaho. Sufficient land is set apart for them to ensure each Indian a liberal income should he choose to cultivate the soil. However, much of the land is rented to white farmers, the Indians generally only cultivating small tracts. This work is done largely by the women. Houses have been built for the Indians, but in most instances they prefer their tepees. In northern Idaho the native dwellings may be seen erected near the houses, while on the Fort Hall Reservation fully 300 Indians live in tepees. Of the Nez Percés, 235 live in permanent houses with floors and 240 live in houses without floors. Many Indians of the State have discarded the costume of the savage. However, on the Fort Hall Reservation there are 1,233 Indians who wear native attire. Extensive agricultural development has taken place on the Fort Hall Reservation during the past 10 years. Approximately 47,800 acres of land on this reservation are under irrigation. Schools are maintained in each of the reservations by the Federal government and by churches. Missions are also located among the Indians. The majority are favorable to education. There is an average enrolment of 415 pupils at the three reservation schools. Idaho and Nevada share the Duck Valley Reservation, which is inhabited by the Piute and Western Shoshone Indians. The Idaho portion of this reservation is in Owyhee County. The Indian affairs are under the direction of the Department of the Interior.

Population.— Population (1870) 13,999; (1880) 32,610; (1890) 84,385; (1900) 161,772; (1910) 325,594. In 1910 the urban territory contained 21.5 per cent of the population. The chief cities are Boise with population of 25,000; Pocatello, 15,000; Twin Falls, 6,000; Idaho Falls, 5,500; Lewiston, 6,043; and Cœur d'Alene 7,291. There are 42 counties in the State.

History.— Lewis and Clark were the first white men to visit the territory in 1805–06. The first permanent settlement was made at Fort Hall. The first agriculturalists and homebuilders were Mormons who settled at Franklin. Idaho originally formed a part of the Oregon country and was claimed by the United States, Great Britain, Spain and Russia. At the time of the Florida Purchase, in 1819, Spain transferred her rights to the United States. Russia did likewise in 1824. In 1818 a treaty had been concluded between the United States and England under which they were to jointly occupy this region. In 1846 this joint occupation was terminated by the establishment of the international boundary at approximately 49° N. which now marks the northern boundary of Idaho. On 3 March 1863 Idaho Territory was organized from parts of the territories of Washington, Dakota and Nebraska. It then included the area now comprising Idaho, Montana and a part of Wyoming. The organization of Montana and Wyoming as Territories in 1864 and 1868, respectively, left Idaho with its present boundaries. In 1889 a State constitution was adopted, and on 3 July 1890 Idaho was admitted into the Union.

Suffrage, Elections, etc.— Idaho extended to women the right of suffrage, 27 Nov. 1896, being one of the first States in the Union to grant this privilege. Every male or female citizen of the United States 21 years old who has actually resided in the State for six months and in the county where he or she offers to vote 30 days next preceding the day of election, if registered as provided by law, is a qualified elector, except those guilty of crime, under guardianship, idiotic or insane. At least 40 days before each general election and whenever he orders a special election the governor issues an election proclamation. All general elections are held in the several precincts in the State on the Tuesday succeeding the first Monday in November every even year. Special elections, when effecting counties only, may be called for public good by the county commissioners, or may be called for a county, district or the State by the governor on 10 days' notice. All elections must be by absolutely secret ballot. By legislative enactment approved 3 March 1915 the State of Idaho was, on 1 Jan. 1916, constituted a prohibition district and the manufacture, disposal and transportation of intoxicating liquors for beverage purposes prohibited in the State of Idaho. All candidates of political parties for Congress and for all elective State, district and county offices, at regular elections are nominated at a primary election conducted substantially the same as a general election. At least 30 days prior to the primary each candidate for office, or some qualified voter in his behalf, files his nomination paper in the proper office. Such paper must set forth that the candidate for office is legally qualified to fill said office and represents the principles of the party for which he was filed. A primary ballot is prepared for each political party on which is arranged in proper order the names of the candidates regularly nominated for office. When an elector offers to vote he calls for the ballot of the political party of which he is a member. He may vote for a first and second choice. The person receiving the highest number and not less than 40 per cent of the first choice votes, or if no person receives 40 per cent of the first choice votes then the person receiving the highest number of first and second choice votes becomes the nominee for such office of the party nominating him.

Municipal Corporations.— The legislature provides by general laws for the incorporation, organization and classification of cities and towns in proportion to population, which laws may be altered, amended or repealed by the general laws. Any county or incorporated city or town may make and enforce, within its limits, all such local police, sanitary and other regulations as are not in conflict with the charter or with the general law. A municipal corporation can in no way become a stockholder or raise money for, or make donations to, or loan its credit to any company, corporation or association, except for school, water, sanitary and illuminating purposes.

Government.— The powers of the government of the State are divided into three distinct departments, the legislative, executive and judicial. The legislative power is vested in a senate and house of representatives. The senate at present consists of 37 members and the house of 65 members. These are elected for the term of two years. Each county is entitled to one senator; the representatives are apportioned by the counties according to population, each county being allowed at least one representative. The sessions of the legislature are held biennially, commencing on the first Monday after the first day of January and are limited to 60 days except at the members' expense. The governor may convene the legislature by proclamation, but no extra session shall continue for longer than 20 days. The executive department consists of a governor, lieutenant-governor, secretary of state, State auditor, State treasurer, attorney-general and superintendent of public instruction, each of whom shall hold office for two years beginning the first Monday in January next after his election. The supreme executive power of the State is vested in the governor. He is commander-in-chief of the military forces of the State, except when called into actual service of the United States. He has power to nominate, and by and with the consent of the Senate appoint, all officers whose offices are established by the constitution and to appoint other officers whose election or appointment is not otherwise provided for, to fill vacancies that may be caused by death, resignation or otherwise in office created by constitution or statute.

The governor, secretary of state and attorney-general, constitute the Board of Pardons, a Board of State Prison Commissioners and a State Board of Examiners. The superintendent of public instruction, the secretary of state and attorney-general constitute the State Board of Public Instruction of which the superintendent is president. The governor, secretary of state, attorney-general, State auditor and superintendent of public instruction constitutes a State Board of Land Commissioners. The judicial power of the State is vested in a court for the trial of impeachments, a Supreme Court, District Court, Probate Court, court of the justice of the peace and such other courts inferior to the Supreme Court as may be established by law for any important city or town. The court for the trial of impeachments is the senate, the judgment of which does not extend beyond removal from and disqualification to hold office in the State. The power of impeachment rests solely with the house of representatives. When the governor is impeached the chief justice shall preside.

The Supreme Court consists of three justices, and are elected by the electors of the State at large for a term of six years. At least five terms of the Supreme Court are held annually. It has jurisdiction to review, upon appeal, decisions of District Courts or judges thereof. It has original jurisdiction to issue writs of mandamus, certiorari, prohibition and habeas corpus and all writs necessary to complete its appellate jurisdiction. It also has original jurisdiction over claims against the State, but its decisions are merely recommendatory, and reported to the legislature. The State is divided into 10 judicial districts for each of which a judge is elected by the electors thereof for a term of four years. A District Court is held in each country at least twice a year and has original jurisdiction in all cases both at law and in equity, also certain other appellate jurisdiction. The Probate Courts are courts of record and have original jurisdiction in all matters of probate, and to hear and determine all civil cases where in the debt or damage claimed does not exceed the sum of $500 exclusive of interest, and concurrent jurisdiction with justices of the peace in criminal cases. Justices of peace have such jurisdiction as may be conferred by law, but not of any case wherein the value of property of the amount in controversy exceeds the sum of $300, nor where the boundaries or title of real property are called in question.

The governors of Idaho have been:

TERRITORIAL

William H. Wallace	1863–64
Caleb Lyon	1864–66
David W. Ballard	1866–70
Samuel Bard (resigned without acting) appointed	30 Mar. 1870
Gilman Marston (resigned without acting) appointed	7 June 1870
Alexander H. Conner (resigned without acting) appointed	12 Jan. 1871
Thomas M. Bowen (resigned without acting) appointed	19 April 1871
Thomas W. Bennett	1871–75
D. P. Thompson	1875–76
Mason Brayman	1876–78
John P. Hoyt	1878–80
John B. Neil	1880–83
John N. Irwin	1883–84
William B. Bunn	1884–85
Edward A. Stevenson (first resident)	1885–89
George L. Shoup (second resident)	1889–90

STATE

George L. Shoup	Republican	1890–91
Norman B. Wiley	“	1891–92
William J. McConnell	“	1893–97
Frank Steunenberger	Democrat-Populist	1897–01
Frank W. Hunt	“	1901–03
John I. Morrison	Republican	1903–05
Frank R. Gooding	“	1905–09
James H. Brady	“	1909–11
James H. Hawley	Democrat	1911–13
John M. Haines	Republican	1913–15
Moses Alexander	Democrat	1915–19

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Thwaites,
R. G.

B. Harvey Allred,
Speaker of the Idaho House of Representatives, 1918.

IDAHO, University of, the State university situated at Moscow, established in 1889 and work was begun in 1892; it is open to both men and women, and there is no tuition except moderate fees in law and music. The government is by the State Board of Education; the curricula offered include the classical course, general science, forestry, home economics, education, civil, mining, electrical, mechanical, engineering, agriculture and law. The Agricultural Extension Division, with headquarters in the State House, Boise, has a staff of 17 workers besides the county agriculturists, and carries on its work by lectures, movable schools, demonstration trains, demonstration farms, etc. The annual income, derived mostly from Federal and State appropriations, is about $255,000; in 1916 the number of students was 865; the number of professors and instructors 85 (not counting the extension staff).

IDAHO FALLS, Idaho, city and county-seat of Bonneville County. It is situated on the Snake River, 30 miles northeast of Blackfoot, and is served by the Oregon Short Line. The chief industry is the manufacture of sugar. Agriculture is also extensively carried on. The municipality owns its own waterworks and electric-lighting plant. Pop. about 5,000.

IDAHO SPRINGS, Colo., town in Clear Creek County, on the Colorado & S. Railroad, about 35 miles west of Denver. It is situated in the plateau region of the Rocky Mountains at an elevation of about 7,600 feet in the picturesque Clear Creek Cañon. The hot and cold soda springs make it a famous resort for health seekers. Since 1859 when gold was discovered at Jackson's Bar, now a part of the town of Idaho Springs, this district has been most productive in its yield of gold and has notable mining tunnels, of which the Newhouse tunnel is the longest in the world. The chief industrial establishments are concentrating mills, lumber-wards and machine-shops. Pop. 2,154.

IDDESLEIGH, ĭdz'lĭ, **Earl of.** See Northcote, Stafford Henry.

IDDINGS, Joseph Paxson, American geologist: b. Baltimore, Md., 1857. He was educated at the Yale Sheffield Scientific School, where he also took graduate work and instructed in mechanical drawing and surveying (1878). Later he went to Columbia University, specializing in geology and microscopic petrography, and continued further study in these fields at Heidelberg. On his return to the United States he was employed by the United States Geological Survey from 1880–92, and again in 1895. Interim he was assistant professor of petrology at the University of Chicago (1892–95), and full professor (1895). In 1914 he was honorary Silliman lecturer at Yale, and was made honorary associate in petrology at the United States Natural Museum (1917). Dr. Iddings is a member of various American and European scientific societies, and in addition to numerous reports and contributions to scientific magazines was joint author of ‘Geology of the Yellowstone National Park’ (1899); ‘Quantitative Classification of Igneous Rocks’ (1903). He translated and published in abridged form H. Rosenbusch's ‘Microscopical Physiography of the Rock-Making Minerals’ (1898); and has written also ‘Rock Minerals’ (1906); ‘Igneous Rocks’ (1909, Vol. II, 1913); and ‘The Problem of Volcanism’ (1914).

IDE, Fannie Ogden (“Ruth Ogden”), American author: b. Long Island, 1853. She has written various juvenile stories, among them ‘A Loyal Little Red-Coat’ (1889); ‘A Little Queen of Hearts’ (1892); ‘Little Homespun’ (1896); ‘His Little Royal Highness’ (1897); ‘Tattine’ (1900); ‘Loyal Hearts and True’ (1900); ‘Friendship’ (1904); ‘The Good and Perfect Gift’ (1904); ‘Little Pierre and Big Peter.’

IDE, Henry Clay, American jurist and diplomat: b. Barnet, Vt., 18 Sept. 1844. He was graduated at Dartmouth in 1866, became State attorney 1876–78, and was a member of the Vermont State senate 1882–85. In 1891 he was appointed United Commissioner in Samoa, and later (1893–97) was chief justice of Samoa under the joint appointment of the United States, Germany and England. He became in 1900 a member of the Taft commission; secretary of finance and justice of the Philippines, September 1901; vice-governor 1 Feb. 1904; and in 1906 governor-general. He was Ambassador to Spain from 29 March 1909 to 23 August 1913. Besides numerous contributions to the *North American Review* and other periodicals he was the author of 'Code of Procedure in Civil Actions and Special Proceedings in the Philippine Islands' (1901); 'The Land Registration Act' (1903); 'The Internal Revenue Law of the Philippine Islands' (1904).

IDE, īd, a fish (*Leuciscus idus*), of the roach family. It frequents the northern lakes of Europe, spawning in April and May in the river outlets. The ide is relished as food. In Germany a species of ide is marketed as an ornamental specimen for aquariums, because of its golden sheen.

IDEA, philosophical and psychological term denoting that which is imaged or conceived in the mind. The word idea has however borne very distinct meanings in the history of philosophy and psychology. Probably to no other term of the kind have there been attached so many different shades of meaning as to the word idea. Yet what the word signifies is of much importance. Till the end of the 17th century, idea had the signification given to it by Plato. The word originally meaning appearance, image, shape, and employed even in philosophy before Plato received and retained from his time a specific sense. With Plato it denotes in the world of things the counterpart of the concept, an immutable essence or being, accessible only to thought. Plato's doctrine of ideas gave stability and objectivity to philosophical concepts. A bold logical fantasy in Platonism transfers concepts to the external world, hypostatising them into independent essences standing over against us. The world of thought which thus originates becomes for Plato the core of all reality, the supporter of the world of sense.

Thus it was Plato who won for the term idea the prominent position it holds in the history of philosophy.

Originally Greek, the term appears to have passed without change into the Latin tongue. In Greek, as we have said, it seems to have meant appearance, shape or form, whence by an easy transition it acquired the connotation of nature or kind. It is equivalent to εἶδος of which it is merely the feminine, but Plato's particularity for this form of the term and its subsequent adoption by the Stoics secured its ultimate triumph over the masculine form. Plato's view comes to this: To the universal notions or concepts which constitute science or general knowledge as it is in our mind, there correspond *ideas* in the objective world. These ideas are not something indwelling in the individual things, as for instance form in matter, or the essence which determines the nature of the object. Each universal platonic idea has its own separate and independent existence apart from the individual object related to it. It also seems to proceed from or to dwell in some celestial world. There is indeed community between the ideas and objects of sense experience. This community consists in participation. The ideas are prototypes, the sensible objects, copies; imperfect imitations of their archetypes.

In the tenth Book of his Laws, Plato discusses 10 kinds of motion, reducing them to two kinds. Inasmuch as he regarded the truth or essence of ideas to consist in self-activity as we see it manifested in life and mind, it will be well to recall these two modes of motion. The one Plato called «movement through another»; he called the other movement through self. For him the latter is the origin of the existence of all being and all change. And it is precisely here that we find Aristotle in agreement with Plato. The former arrives at the same thought and calls it οὐσία but retains idea, Greek ἐίδος for «species,» using «entelechy,» to convey the notion of the «self-active cause of life.» For Plato the ideas were independent sovereign forms. In post-classical Hellenism, we find Philo of Alexandria using idea to denote the thoughts of the Divine Spirit. Accordingly we here not only have a unity as a source of all multiplicity, but the whole of reality is supported and spiritualized by a universal Soul. Likewise, mighty movements were introduced by the fact that the powers mediating between the Deity and mankind were combined into the unity of the Logos or World-Reason, the first-born Son of God. Even with Origen the essence of reality consists of an invisible world of ideas. Thenceforth the doctrine becomes a constituent element in Christian speculation; and material being originates subsequent to this invisible world, and continually requires its constituting and animating power.

From Descartes onward usage has become confused and inconstant. John Locke in particular ruined the term for English philosophy, where it has ceased to have any recognized definite meaning. He tells us: «Whatsoever the mind perceives in itself, or as the immediate object of perception, thought, or understanding, that I call idea.» He says further that he has used the term to express whatever it is which is meant by phantasm, notion, species or whatever it is which the mind can be employed about when thinking. In fact, with Locke, idea appears to denote indifferently a sensation, a perception, an image of the imagination, a concept of the intellect, or emotional feeling, and sometimes the external material object which is perceived or imagined. Yet in spite of Locke the word was used in the Platonic sense in literature as well as in philosophy till the 17th century. Examples in literature are to be found in Spencer, Shakespeare, Hooker and Milton. Thus in 'Paradise Lost':

> "God saw his works were good,
> Answering his fair idea."

The fortune of the word idea is curious enough. Employed by Plato as described above it stands in lofty contrast to the unreal images of Plato's sensible world. But it was lowered by Descartes who extended it to the objects of our consciousness in general. And when, after Gassendi, the school of Condillac had analyzed our highest mental faculties into our lowest, idea was still more degraded from its Platonic position. «Like a fallen angel, it was relegated from the sphere of Divine intelligence to the atmosphere of human sense. . . .» (Hamilton).

Locke followed Descartes who, instead of employing the words image, species, phantasm in speaking of the mental representations of sense-perceptible objects, used the word idea. Hume tells us that all the perceptions of the human mind resolve themselves into ideas and impressions. With him the idea is a purely mental structure or content which is a less vivid copy of an original sensation, emotion or volition. With Kant an idea becomes a transcendental conception of the pure reason, such as the idea of God. With Hegel the highest thought of the logic is named by him *Idee,* suggesting Plato's highest principle. Idee thus suggests the final category of the Hegelian dialectic — the realized ideal, energy in its supreme manifestation; it is the Absolute Idea, or the Absolute. At the present time many psychologists use the word idea only for a complex that does not arise from direct outward impressions. They thus use it for the so-called memory-images. For ideas formed from outward sense-impressions they generally use the word perception. Wundt does not regard this distinction as of any importance, since, as he says, there is really no valid difference between memory ideas and the so-called sense perceptions. Yet, according to Professor Stout, the existence of ideas is subsequent to that of percepts, and even implies some complexity of perceptual cognition. Perhaps, however, all agree that ideas are symbols, symbols having a meaning. The whole realm of mental representations may be viewed with regard to either their symbolism or their significance. Considering their symbolism ideas of things as well as ideas of relations are not unreasonably regarded as products of the mind. But considering their meaning, ideas represent realities. In other words, their contents or that which they signify is real. There are indeed some ideas that are not even representations. Such are solely of an auxiliary nature, comparable to tools of the mind. Such are hypotheses. This brings us to the concept of content. Content, obiter dicta, is absolutely incomprehensible from a merely mechanical view of the world. For who could explain the meaning of a word mechanically? Content involves a principle of order — that of objective reality, meaning and dependency. We perceive this for example in the relationship of the characteristic marks of a logical concept to one another. Only grossest misunderstanding can confound the inner structure of such a concept with the juxtaposition within a mere sense-presentation. The fundamental form of connection in the case of such a concept is one of system. Each element stands within a whole, under the influence of a whole, and remains subject to its compelling power, while the various elements mutually determine one another.

Nowadays it is not seldom that one comes across the word idea combined in phrasal connection with other words. A consideration of the more important of these cannot be out of place. Some psychologists speak of a dominant idea. They mean by this an imperative or insistent idea, such as besets the mind, and this in spite of all effort to inhibit it and in spite of one's assurance of its unreasonable character. We may remark here that every idea considered, not as a mere feeling, but as a brain-movement fit to serve as an irritation to action will, if not inhibited, pass into an action, whether it be connected with consciousness or not. Thus a persistent or obsessing idea may become dangerous to the one holding it. It is usually a train of thought which a subject cannot banish or escape, though he recognizes its falsity or triviality. Such imperative or dominant ideas exist in all degrees of intensity, from the "sound that sings in the ear" to such obsessions as agoraphobia. In this sense it is the same with a fixed idea. Fixed ideas are delusional ideas or trains of thought which dominate the mind in certain forms of insanity or monomania.

By a free idea experimental psychologists understand an idea or representation which is dissociated from sense-perception or presentation and from the organic impulses connected with sense-perception. A free idea is thus one which may take its place in an associative train, and may be used in the process of discrimination.

By an implicit idea, Höffding understands the idea or group of ideational elements that fuses with the presentation in the act of perception. It is thus the ideational associate that raises a datum of sensation to the rank of a perception. An extrinsic idea is a temporal or spatial idea. Spatial and temporal ideas are immediately distinguished from intensive ideas by the fact that their parts are united in a definitely fixed order. Ideas with such a fixed arrangement are called in general extensive ideas.

Thus no word in philosophy or psychology has been responsible for more confusion than the word idea. Yet what the word signifies is of utmost importance. Its sense in the minds of some philosophers is the key to their entire system. Nowadays it sometimes means merely an opinion; sometimes mental images; and we even find it employed merely as an element in a periphrasis (as in "to have an idea on"). It is thus one of the most important words in the history of thinking and at the same time one of the least understood. See INNATE IDEAS.

IDEA OF A UNIVERSITY, The. Cardinal Newman's 'Idea of a University' is a collective volume composed (1) of a course of nine lectures delivered (1852) to the Roman Catholics of Dublin, (2) of 10 occasional lectures and essays addressed (1854–58) primarily to the members of the Catholic University of Ireland while Newman was its rector. The former part is a consistent whole, dealing consecutively with fundamental considerations of university teaching: with theology as a branch of knowledge, with the relations of theology to other knowledge, with knowledge considered as its own end and in relation to learning, to professional skill, and to religion, and finally with the claims of knowledge upon the Church. The second part deals with the relations of Christianity to letters and to science, with the study of literature, with elementary studies, and with a few more special topics. Of these 19 discourses the best known are 'Elementary Studies,' which is largely in vivacious dialogue, and 'Literature,' which is so persuasive and suggestive that it has been widely quoted both as counsel and as a model of style. The other discourses have more general interest than is immediately suggested by their titles. To dismiss them as special in subject and audience is to ignore both the unfailing force and beauty of Newman's expression and the largeness of his philosophical conceptions. Educated himself at Oxford, he was never provincially English; and during his maturity his associations in the Roman Church with men of Continental training widened his acquaintance with the practical problems of higher education. But his great claim upon the general public, a claim hardly second to his literary distinction, is that he deals, not with the technic of pedagogy, but with university education as the development of the whole man. His conception of this total development as essentially moral, pervading his exposition, makes it both large and persuasive. Though the university as «a place of teaching universal knowledge» has for its immediate object the intellectual rather than the moral, yet «practically speaking, it cannot fulfil its object duly . . . without the Church's assistance . . . the Church is necessary for its integrity.» Animated by this idea of the integration of university studies in the development of Christian manhood, his discussions embrace not only such practical matters as the relations of teaching to research, but the larger aspects of liberal education.

Charles Sears Baldwin.

IDEALISM. This word is not easy to define briefly, as it is used in many connections where the common element in the various significations it takes on are not at first sight apparent. We may say at once, however, that idealism is a fundamental attitude or point of view from which men interpret the world, or some special phase of human experience. Its essential characteristic is found in the fact that it interprets the reality with which it deals as having a meaning, an idea, apart from its sensible appearance, and assumes that in this inner significance its truth and ultimate essence consists. Not the outward show of things, not the fact of coexistence and sequence among sensible phenomena, but the meaning or «idea» is for idealism the point of primary importance in understanding either the world as a whole, or any of its various parts. Now, as Plato perceived, this inner idea of anything is ultimately identical with its «good,» i.e., what it is good for, its purpose or function in a rational system of things. Accordingly, the essence of idealism is found in its teleological mode of explanation. This point of view, when logically carried out, implies further that what is real is rational or intelligible, since its idea can be grasped. That means, in other words, that mind or intelligence is the ultimate principle in which things find their explanation. Moreover, it of course follows that the material world with its mechanical laws is in some sense secondary and derivative. Idealism is thus directly opposed to materialism (q.v.) and mechanicism, which takes matter or energy or some unintelligent form of existence as the *prius* from which everything else is derived. Realism, as a philosophical theory, affirming the existence of a reality apart from subjective experience, is not properly contrasted with idealism; though, as we shall see later, these terms are used to denote opposing tendencies in literature and art. It is, however, a mistake to suppose that idealism denies objective reality and reduces the world to sensations and ideas in the mind of the individual. On the contrary, the more adequately the principle of idealism is grasped, the more completely is justice done to the objective side of experience.

Science, including philosophy, religion, art and literature, are all different ways of interpreting life and existence, involving, indeed, varying attitudes of the self toward reality, and varying degrees of explicitness. Religion, art and literature differ from science and philosophy in not being reasoned interpretations of reality, but primarily expressions of the emotional or feeling aspects of experience. Yet the various sides of experience are not independent and isolated, but act and react on one another as parts of a functional unity. Consequently, the interpretations of religion, art and literature presuppose more or less explicit theories about the nature of things. These, however, exist in the form of unexamined assumptions and uncritical standards of value. With regard to these interpretations, we can at once say that all forms of religion which rise above mere fetichism necessarily presuppose an idealistic view of the world. This is obviously true of a religion like Christianity. But even if a religion denies individual immortality and the doctrine of a personal God, it cannot exist without assuming that the universe is to some extent governed by the ideas and purposes of a superhuman power (or plurality of powers), and that it is not therefore a mere play of mechanical phenomena. Art and literature, too, are naturally — at least in their highest forms — affiliated with idealism. For the emotional and æsthetic satisfaction at which they aim can be fully attained only on the assumption that the ultimate nature of things is in harmony with the demands of the human spirit, and that therefore these ideals are not vain illusions. There are, however, two causes which at certain periods bring about a reaction against idealism in these fields and give rise to what is known as realistic art and realistic literature. In the first place, the conceptions of science and philosophy are at certain periods so prevailingly mechanical and naturalistic as to fetter the wings of imagination and render impossible any idealistic interpretation on the part of art and literature. If the world is demonstrably unmeaning and mechanical, there is no permanent artistic satisfaction in a false idealism. The imagination cannot be divorced from reason, but must find its satisfaction in representing things in harmony with their true nature and known laws of action. But, again, realism in art and literature may be the result of a one-sided idealism, which, by ignoring the aspect of things that science emphasizes, gives rise to the same divorce between the truth of fact and the truth of art. It is clear that if idealism is to prevail in these fields it must not ignore the facts and laws of the natural world, or run counter to them, but must do justice to these facts while its transcends, through its interpretations, the scientific standpoint. Mere idealism, then, is an unsatisfactory standpoint in art and literature, and the reaction toward realism to which it gives rise is justifiable and necessary. In a somewhat similar sense, «idealist» is used popularly as a term of reproach to denote a person who ignores the facts and practical conditions of any situation, construing it in a one-sided way in terms of his own ideas of what ought to be. But idealism, to be adequate, must go beyond the uncritical ideas of the individual. The true idealist is the man whose ideas are adequate to the situation in all its complexity and concreteness, whose interpretation of what is and ought to be is derived from a penetrating analysis of all the objective conditions.

What of the relation of natural science and philosophy to idealism? It is obvious that the very task of the natural sciences necessitates the adoption of conceptions which are fundamentally different in character from those employed by idealism; for science is primarily concerned with the relations of particular phenomena. It is always concerned with the mechanism of the parts, and knows nothing of the ideal purpose or significance of wholes. As Kant said, «where mechanism ceases there ceases also the possibility of scientific explanation.» This is the ground of the long-standing quarrel between natural science on the one side and idealistic philosophy and religion on the other; the former can interpret the world only in mechanical terms, while the latter must read it in terms of teleology.

The history of thought shows that both these methods of explanation have steadily confronted each other in philosophy. Idealism and materialism were developed almost simultaneously in Greece — the former by Plato and the latter by Democritus — and the division between these opposing principles under one form or another persists until the present day. Although philosophical systems necessarily vary with the changing intellectual and social conditions of different periods, yet it remains true, as Fichte said, that in principle «there are and can be only two systems of philosophy, idealism and materialism, and that neither one can directly refute the other, since they are constructed upon totally different planes.» Materialism, as philosophy, adopts the conceptions and methods of the natural sciences, and differs from the latter only in the greater scope and generality of its problems. It aims to be (in Spencer phrase) «completely unified science.» Idealism, as we have already seen, has a different problem from that set by science, and states its conclusions in terms that are quite foreign to the latter.

It is usual to distinguish between subjective and objective idealism. The former is an incomplete and undeveloped form, and finds its best representative in Berkeley (q.v.). It resolves material existence into a series of ideas in the mind of the individual, holding, in Schopenhauer's phrase, that «the world is my idea.» The proof that it offers for this position is based mainly on the epistemological thesis that we know and can know nothing but our own ideas. The difficulties and inconsistencies of this view are now generally recognized, and the idealism of the present day is known as objective idealism. This does not deny the existence of external reality, but finds implicit in it the same principles of reason and purpose that are present in the individual mind. Indeed, this is true of the great idealistic thinkers of all times — of Plato and Aristotle, no less than of Schelling and Hegel. As a philosophical system, idealism has, of course, to formulate its conclusions in a series of logical propositions and to furnish proofs of their validity. In doing this it does not depend upon the Berkeleian argument mentioned above, but rather proceeds by way of a criticism of the standpoint and categories of natural science. That is, idealistic philosophy attempts to show that the scientific standpoint, when taken as philosophy, i.e., as an ultimate account of the nature of things, is in itself incomplete and inconsistent and that when the necessary supplementations and corrections are made it points the way to a view of the world as a rational and purposive system. To make our view of the world completely consistent, many idealists maintain, we are obliged to hold that all its parts are included in an all-embracing system of experience, which finds its unity and its ultimate reality in the ideals and purposes of an Absolute Mind.

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IDEAS, Association of. See ASSOCIATION OF IDEAS.

IDENTITY, meaning in general the state of being the same, can be predicated properly only of individual things. The philosophical consideration of identity has been undertaken from three different points of view. Identity was thus approached as:

(1) The logical law of identity; (2) the metaphysical concept of the identity of a thing; (3) the special psychological form which this concept takes in the case of a conscious being or person.

1. There are certain very general principles exemplified in all thought, and some have supposed the task of logic to consist merely in developing their implications. These principles are known as the law of identity, the law of contradiction and the law of excluded middle. We are concerned here only with the law of identity; the other laws have been named to reveal the position of this law among its correlatives in the science of thought. The law of identity may be formulated by saying that «whatever is, is»; or symbolically, that «A is A.» In other words, if we think about anything then we *must think*, according to the law of identity, *that it is what it is*. This so-called necessity of thought amounts really to the apprehension of a necessity in the being of things. The law of identity and the law of contradiction is metaphysical or ontological. In the case of the former law, this is because whatever *is* must be *determinately* what it is,— that one must think it *is*. The law of excluded middle is so far different as a disjunctive proposition expresses doubt, and doubt belongs to mind, not to things. Unless the primary laws of thought were laws of things as well, our thinking would be doomed by its very nature to misapprehend the nature of things.

The logical law which we are now considering in particular is best understood as simply the positive form of that axiom of all consistent thinking which the law of contradiction states negatively. Thus we are reminded by the latter that a judgment cannot be now true, now false. But if true at all, it must remain true always. For if the truth of a judgment fluctuated without any change in the subject matter of such judgment, all thought would amount but to confusion. All the functions peculiar to thought receive their differentiating characteristic only through a detachment from the flow of sense-presentation and by establishing themselves as independent of it: the judgment presents its content as something fixed in contrast to the stream of presentations; it proclaims its connection of ideas to be something that does not pass away with the act of connecting them, but persists in face of all the changes of the psychical life. Thus all truth is eternal.

2. Sir William Hamilton well observes that the identity is the relation between our cognitions of a thing, not between things themselves. Let us consider briefly the metaphysical relations of the logical law of identity. It is metaphysical, we said, because whatever *is* must be *determinately* what it is, that one must think it so. Owing to considerations like these, philosophers find it difficult in admitting the possibility of an absolute change — change when nothing remains the same. For in such a change one cannot say *what it is* that changes. In this spirit Kant remarked «only the permanent can change.» May we not suspect, however, that the great Königsberg thinker here unthinkingly reifies, employing his favorite «thing-in-itself,» synonymous with Spencer's «absolute»? For let one ask: What is that which remains unchanged or permanent? How are we to conceive it? And how are we to conceive of the junction between the abiding nature of a «thing» and the changing states? These are very difficult questions to answer, as any perusal of Berkeley will show. For no doubt what the word «thing» conveys is a mere logical construction,— all the aspects of a «thing» alone being real. Cognition analyses «things» into bundles of *relations* and all these relations together making up the thing. What appears to be the truth is that the conceptions «things» and «relations» are inventions pure and simple for describing certain parts of the whole, as well as certain interactions and interconnections in a world-conception. In reality there are no things. These are only actions. In the notion of «things» inheres the physical assumption of a continuity. By *being* itself we understand the *immediacy* of ceaseless change. In a hypothetical sense, continuity may be allowed to be a necessary condition if two appearances are to be classed as appearances of the same thing. By one «thing»— a «Hilfsconstruction» as it is — we mean a combination of sensible continuity and causal connection; it is a certain series, namely, those which would commonly be said to be of the thing. If the a priori belief in permanence or continuity had not existed the laws which are now formulated in terms of this belief might just as well have been formulated without it. Things are those series of aspects which obey the laws of physics.

The metaphysical discussion of identity is concerned with a number of other questions such as the foregoing. It would lead us too far afield to discuss them all here. (See METAPHYSICS). Philosophers discuss in this connection besides the various senses in which identity is known from qualitative likeness, in particular the relation of identity to difference; whether identity excludes difference, or on the contrary implies difference. Such questions are, on the whole, no doubt partly verbal, and partly psychological; but they also lead very often back to very fundamental problems of philosophy.

(3) The psychological problem of personal identity was raised into prominence by the somewhat paradoxical discussion of Locke in his 'Essay Concerning Human Understanding.' These discussions David Hume, in his 'Treatise on Human Nature,' subsequently followed up with an analysis in keeping with the skeptical bias of his thought. The difficulties of the notion of personal identity which appear in these early essays are even more complicated in modern psychology. Into psychological literature of late have been introduced the terms «double personality,» «double soul,» and «double ego.» To many minds the difficulties seem rather increased than diminished by the introduction of these strange combinations; they are phrases which tend rather to mystify than to clear our ideas. While the words serve for certain problems it is well to observe that authors are not lacking who deal with the psychological problem as if they were talking of a psychic fluid or vapor floating about us. On the bases of these hypotheses, of course everything becomes possible, and the human body may as easily be considered as not as the haunting place of two or even of a multiplicity of ghosts. We have no need of such hypotheses. For the spheres of the peripheral and the central soul are not distinctly separated by any definite boundary. Therefore the difficulties raised to meet the notion of personal identity by those who cite cases of double and alternating personality need not be regarded as insuperable.

A few observations on the situation as a whole will help us to grasp more easily the idea of a continuity underlying the notion of personal identity. First, a man is not the sum of the material particles of which at any given moment he consists. The material particles are not the really essential elements that makes a man what he is. For instance, all animals breathe the same air; but all animals are not therefore persons. In truth a man's material existence is constantly undergoing change, and yet we remain the same person to-day that we were yesterday. But let us ask a question; it will confirm our notion that this is true. Let one ask, am I for that reason another person because I cannot think the same thought twice with the same molecules? Does the thought change because the oxygen engaged in the first act of thinking has entered into new chemical combination and is soon to be discarded from the system as waste? One knows that to answer this in the affirmative is like declaring that the significance of a word changes when it is written once in pencil and once in ink. And yet it is not easy to discover the grounds of such conviction. For there are other considerations than materiality which appear to go yet deeper, making us seek the position of the continuity which we suspect to exist, even at a lower, more profound level. Says even Ernst Mach, whose achievements for psychology are by no means small: «It would hardly be possible for there to be greater difference in the egos of different men than appear in the course of a year in *one* man. When, to-day, I look back upon my early youth, if the chain of recollection were not present to my mind, I should have to believe (apart from a few special points) that the boy was another individual.» These and a number of equally interesting observations leads him to declare that the «ego is a little absolutely permanent as are bodies.» We are prevented, however, from assenting to this conclusion by the consideration that our ego is in reality more than a current of sense impressions, as Mach understands it. Some understand by such words soul, ego, personality, etc., mere states of consciousness, and Mach here appears to be among them. It is apparent that a difference in terms is here the underlying difficulty. When Mach denies the independence and permanence of the ego, this is because he confuses the *consciousness* of the ego with the living ego itself. Our very knowledge is shaped by *our* independent work. Moreover, it is necessary to call particular attention to the fact that above and beyond all intellectual processes there develops an inner life, a life which exhibits, in spite of all manifoldness, a permanent character, persisting through all changes and movements. Right through all his work and the complexities of his development man has always drawn further and further away from the mere life of his senses. He has more and more converted outward events into inner experience; more and more resisted the mere influx of sensations. And all this is no mere intellectual phenomena. It is the unfolding of a rich actuality, the nearest and surest of which we have any knowledge; and this alone teaches us how mentally to shape and reshape our sense impressions. There is thus a unity of a spiritual kind which persists with living force in the face of all the changes and obscurations of consciousness, as in sleep. As opposed to Mach's dissipation of the «ego,» there are thus experiences of the spiritual life which corroborate Goethe's conviction:

> "Und keine Zeit und keine Macht zerstückelt
> Geprägte Form, die lebend sich entwickelt."

Which may be freely translated

> **"And neither Time nor Might dissolves
> Identity that life evolves."**

But let us examine yet a little more clearly. We have alluded to the familiar fact that material particles of living beings are constantly changing. In anyone's body there persists no sameness of substance whatever. The identity of a living being is not maintained through the presence of a soul-monad, but through the preservation of its *form*. By life we understand organization. By soul we understand the *form* of an organism. Mind, spirit, soul, ego, are synonyms. We speak of soul when we emphasize the sentiments of a man; of mind when we refer mainly to man's rational powers; of spirit and ego when thinking of the significance and character of thought without reference to bodily conditions. That which pertains to soul is called psychical; that which has meaning is called spiritual; that which characterizes intellection is called mental. All the many subconscious and conscious memories which form the elements of our mentality are definite traces of former sense-impressions, reacting upon new sense impressions and embodying sentiments, and thoughts, the forms of which are preserved in the cerebral system, the substance of which is constantly changing. But man's personal identity consists not in any way in an identity of material particles, but in the sameness of soul-form which is preserved by the continuity of his existence. This we think is the whole secret of personal identity.

IDES, one of the threefold divisions of the Roman month. See CALENDAR.

IDIOCY, that condition in which there is permanent mental deficiency which has resulted from a disease or deficiency of development of the brain either before or at the time of birth or at an early period of life. It is thus academically distinguished from a psychosis, which is a condition of mental disturbance occurring in the developed brain. Idiocy is a term of very wide applicability owing to the fact that very many grades of arrested development occur. In a general sense it is applied chiefly to the worst of these forms, while the term imbecility is used to denote the milder forms. The distinction between idiocy and imbecility is thus a somewhat arbitrary one, for the two conditions shade into each other by almost imperceptible degrees. An idiot is unable to attend to himself; an imbecile may.

Causes.— The causes which result in idiocy and imbecility are often very obscure. A large proportion of cases are congenital; that is, they arise from causes acting *in utero*. The child is born with a brain already hopelessly impaired. Heredity is thus a very evident cause; defects in the ancestral stock and vices in the parents and near progenitors are doubtless very active. Alcoholism, syphilis and other chronic poisoning, chiefly lead, are certainly among these causes; as well as consanguinity and various diseases in the parents. Injuries to the mother while pregnant may be responsible. The subject of ante-natal disease is still a very obscure one, but evidence is not lacking to show that the fœtus may suffer from disease; and in the critical stage of development of the brain before birth this organ may suffer irreparable damage. The same may be said of the infant and very young child. Injury and disease may act most disastrously upon the undeveloped brain. Thus blows upon and injuries to the head may cause idiocy; also injuries at the time of birth, due to difficulties in the labor, may act. The various infectious diseases of childhood are responsible for some cases; thus scarlet fever, measles, whooping cough and cerebro-spinal fever have been noted as causes of permanent arrest of development. No doubt in many cases it is difficult or even impossible to detect the active cause.

The following are the most universally recognized varieties of idiocy:

Microcephalus.— In this form the brain and its enveloping skull-case remain abnormally small. In extreme grades the deformity is very striking. These are among the lowest and worst forms of idiocy, and in some cases there is scarcely a spark of intelligence. The patient cannot be said to do more than vegetate. The original cause probably acts in these cases at a very early period in the ante-natal life, and determines an almost complete arrest of brain development.

Hydrocephalus.— In this form the natural cavities or ventricles of the brain become enormously distended and the skull is correspondingly enlarged. The mental impairment varies within wide limits. In some cases the idiocy is almost if not quite as great as in microcephalus, but in other cases a fair degree of intelligence is preserved. There may be also various forms of paralysis, speech defect, epileptoid seizures and impairment of the special senses. Hydrocephalus probably depends upon closure of one or other of the outlets of the cerebro-spinal fluid between the ventricles of the brain.

Porencephalus.— Occlusion or stoppage of one of the main arteries of the brain at an early period of development, not necessarily ante-natal, may cause such an arrest of development of a portion of the brain-mass that a cavity results, and this is called porencephalus. Such a stoppage of an artery may be caused presumably by injury or by one of the infectious diseases. The symptoms are usually arrest of development of the mental faculties in various degrees, speech defects, paralysis, such as hemiplegia, athetoid movements and epilepsy.

Mongolian Idiocy.— In some cases the patient bears a real or fancied resemblance to certain racial types, as the Negroid, Mongolian, etc. The latter of these is the best marked, and is now included (after Langdon Down) in most descriptions. The patient's head is deficient in the posterior region; he is of short statue, has oblique and widely separated eyes and a flattened nose. The attempt is made by some writers to construct special mental features for the Mongolian idiot, but with not very great success. He is simply an idiot, with varying degrees of mental power, and his resemblance to a Calmuck is only accidental.

Paralytic Idiocy.— In the fœtus and in the infant and very young child certain accidents or diseases may cause cerebral hemorrhages, which, just as in the adult, cause in turn various kinds of paralysis. The most common are hemiplegia or paralysis of the arm and leg on one side; diplegia, or paralysis of both arms and legs; and monoplegia, or paralysis of one limb. Such an accident in early life is apt to cause more or less idiocy or imbecility in addition to the paralysis. Some of these patients also have epileptic attacks.

Epileptic Idiocy.— A rather large proportion of feeble-minded children also have epileptic attacks. This symptom may be associated with paralysis of various kinds, as already said, or it may not be complicated in any way with marked physical defects. It is only too likely, however, to induce a progressive mental deterioration; or, to speak more accurately for some cases, to prevent a normal brain development. The epileptic child is usually feebleminded — some more, some less.

Sensorial Idiocy.—In some cases the organs of sight or hearing, or both, may be defective or undeveloped, and the child's brain does not develop normally merely because it is deprived of these important avenues of sensation. Such children may have more brain capacity than at first appears, and they can be educated. In some cases, however, as in some deaf-mutes, the mental faculties remain more or less undeveloped.

Genetous Idiocy.— Ireland, a well-known authority, proposes this term for a certain class of congenital idiots, but it is not very distinctive. It includes feeble-minded children, usually of a rather low grade, who are born with undeveloping brains. The term really applies to many members of the other groups already referred to.

High and Low Grade Idiots.—These terms and intermediate ones are often applied merely to designate feeble-minded children according to the approximate degree of their lack of development. While lacking in scientific precision, such terms denote conveniently various grades of idiocy. There are many idiots who are not microcephalic, nor hydrocephalic, nor Mongolian, nor paralytic, nor epileptic, nor in fact to be included in any usually accepted class, and yet they are unmistakably idiots, and often of low grade. The truth is, that all classifications must remain unsatisfactory until we know more about the causation and pathology of the various forms.

Cretinism.— A highly specialized form of idiocy is cretinism. This is always associated with defect in the thyroid gland; sometimes this gland is entirely absent, in others it is immensely hypertrophied, and thus practically destroyed. Cretinism is endemic in some countries, as in and about the Alps and Pyrenees. The cretin is both physically and mentally stunted. He is of low stature, of peculiar and characteristic physiognomy, of pale and unhealthy skin, usually beardless, sometimes sexually undeveloped, and with many defects in the skeleton and muscular system. Mentally he is usually an imbecile at least, and in some cases even quite idiotic. Cases vary very widely, however, in the degree of feeble-mindedness. In the United States cretinism is only sporadic.

Pathology.— As already indicated, idiocy is due to a wide variety of causes, and therefore its pathology also varies extensively. Among the processes found in the brains of idiots are sclerosis, atrophy, porencephalic defects, old inflammations, occluded and destroyed blood vessels, distended ventricles and thickened membranes.

Treatment.— In recent years the effort has been made to train and educate the feebleminded child, and to develop in it as far as possible the defective mental faculties. Training schools for these patients now exist in this country and in Europe, and the most humane and enlightened efforts are being put forth to ameliorate the condition of these unfortunates, and to render the more hopeful of them useful members of society. It is needless to say, however, that not much can be accomplished with feeble-minded children of low grade, and with the very lowest nothing whatever can be done. With the imbecile and demi-imbecile, however, the results obtained sometimes justify the pains and expense. For the vast majority of feebleminded children asylum treatment is desirable, even indispensable. These unfortunate patients cannot associate with healthy children, and they require a special environment. The prospect for cure in most cases is quite hopeless.

Cretins may be cured by the use of thyroid gland. See also INSANITY.

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IDIOM, ĭd'yŭm, a form of phrasing or terminology peculiar to a language. Its basis is in popular usage rather than in grammatical or logical construction. The same term is applied to a dialect or general variation of a language. Idioms are not capable of literal translation into other languages, e.g., the French “ça m'est égal” is rendered by the English idiom “it's all the same to me.”

IDIOSYNCRASY, ĭd'ĭō-sĭn'krā'sĭ, any individual peculiarity, either mental or physical. Such peculiarities are frequently a sign of abnormality or insanity, such as a peculiar arrangement of one's dress, pronounced antipathy to certain persons, constant obsession that attempts are being made to poison one, etc. Physical peculiarities arise mostly from abnormalities in the metabolic system of the individual, such, for instance, as a rash caused by eating a small quantity of strawberries, lack of response to certain stimulants, medicines, etc.

IDIOT. See IDIOCY.

IDITAROD, ē-dē'tạ-rōt', Alaska, a mining town, located in the region of the Iditarod and upper Innoko valleys, 510 miles distant from Seward. It is a prominent gold-mining centre and has wireless telegraphic communication.

IDO. The artificial language known as Ido had its origin in the work of the *Délégation pour l'Adoption d'une Langue Auxiliaire Internationale,* founded in 1900. The Delegation devoted seven years to an examination of more than 60 schemes for an artificial language and in 1907 appointed a working committee of 16 eminent representatives of all important language groups with the object of summing up the previous work of the Delegation and adopting an international auxiliary language capable of serving the needs of science, commerce and general intercourse. The committee, after exhaustive consideration, decided to adopt in substance the Esperanto (q.v.) of Dr. Zamenhof, because of its many excellencies, but with certain important alterations, the chief of which were: (1) the replacement of certain letters requiring special type by Latin letters, thus allowing the language to be printed anywhere; (2) suppression of certain useless grammatical rules in regard to the invariable use of an accusative form and concord of adjectives; (3) regularization of word derivation, in order to make the language a more fit instrument for the expression of exact thought; (4) enrichment of the vocabulary by all words necessary to translate exact ideas, in accordance with the principle of maximum internationality. The initiation of most of these reforms was chiefly due to Marquis L. de Beaufront, the Saint Paul of the Esperantist movement, who submitted them to the committee in a pamphlet under the pseudonym of “Ido” (i.e., a derivative) and which were voted on and unanimously adopted without knowledge as to the author. Rapport was attempted with the leading Esperantists in the hope that they would carry out these necessary reforms. The Esperantists, however, then at the height of their success and for certain practical reasons, refused to consider any changes. There was then formed the *Uniono di la Amiki di la Linguo Internaciona,* with an academy for linguistic study and a directing committee, composed of such eminent scholars as the philologist, Otto Jesperson of Copenhagen, the philosopher and authority on international linguistics, Louis Couturat of Paris; scientists as L. Pfaundler of Graz, R. Lorenz of Zürich, and F. G. Donnan of Liverpool, with the famous chemist, William Ostwald of Leipzig, as president. A monthly journal, *Progreso* (Paris), was established under the editorship of Professor Couturat. The academy, with the criticism and suggestions of more than 100 other persons interested in the subject, continued the work along the lines laid down in the recommendations of the delegation committee and in 1914 had practically completed its labors. During the years 1915–16 there were printed the large revised Ido–French and Ido–German dictionaries and considerable work done on an English edition. Because in a formative period, no extensive propaganda of Ido has heretofore been attempted, yet the *Uniono* has received the adherence of several thousands and had brought about, prior to the war of 1914, the printing of about a dozen small journals in the language.

Ido is indebted to Prof. Otto Jespersen for the happy formula which best expresses its basic principle: “That international language is best which is easiest for the greatest number of men” (an adaption of Bentham's famous ethical formula).

The vocabulary of Ido is made up by adopting as root-words that form of word most readily recognizable by the greatest number of Europeans and not merely by empirical selection, as in Esperanto, or by counting each language as of equal importance without reference to the numbers using it, as in Idiom Neutral. As a result, Ido is but the quintessence of existing European language without the unnecessary duplications, rules and exceptions. It can practically be read at sight by any educated European. To speak and write it properly demands considerable study, because of the numerous idiomatic phrases which exist in all natural language, yet it is beyond comparison easier of acquirement than the like task of learning any foreign language. Because of the large proportion of Romance roots found in the English and the adoption of many Latin derivatives into the Germanic and Russian languages, Ido has a predominately Romance appearance. The spelling is phonetic, with an avoidance of double letters, difficult diphthongs and heavy accumulations of consonants difficult of pronunciation.

The grammar is entirely without the irregularities which make natural languages so difficult and is very simple, though sufficient for all logical demands. All nouns end in -o in the singular, -i in the plural; adjectives in -a; adverbs in -e; gender follows the natural method of the English; the verb is invariable in number and person; the auxiliary verb *esar* is used for the passive and compound tenses of the active, *esas amata* (is being loved); *esas amanta* (is loving); the indicative present, past and future is formed by adding -as, -is, -os; conditional, -us; imperative, -ez; infinitive present, -ar; active and passive participle, -anta and -ata.

The logical system of word derivation is chiefly the work of Professor Couturat. One has but to learn the root word and a limited number of prefixes and suffixes in order to give grammatical form to any idea which the root word is capable of expressing, or from any one grammatical form to work back logically to the other forms. This system of word-building wonderfully simplifies and enriches the vocabulary, furnishing, as Professor Couturat states, "*an instrument of precision* for the analysis and exact expression of thought, which is very superior, from the point of view of logic, to our traditional languages, encumbered as they are by confused and ambiguous expressions."

The following sentence, translated from Lincoln's Gettysburg address, may serve to indicate some general differences between Ido and Esperanto. The Lord's Prayer which follows is written in Ido. Generally speaking, all consonants are pronounced as in English; the vowels having the values of a, as in father; e, as in vein; i, as in machine; o, as in soul; u, as in rule:

ESPERANTO	IDO
Antau kvar dudekoj da jaroj kaj sep niaj praavoj kreis sur tin chi kontinento novan naciono, naskitan en libereco kaj dedichitan a la propozicio ke chiuj homoj estas kreitaj egaluloj.	Ante quar duadeki e sep yari, nia avi genitis sur ica kontinento nova naciono, koncepita en libereso, e dedikita a ta principo, ke omna homi esas kreita egala.

ORIGINAL

" Fourscore and seven years ago our fathers brought forth upon this continent a new nation, conceived in liberty, and dedicated to the proposition that all men are created equal."

LORD'S PRAYER

Patro nia qua esas en la cielo, vua nomo esez santigata; vua regno arivez; vua volo esez obediata, quale en la cielo, tale sur la tero. Nia singladi' panon donez a ni cadie; e remisez a ni nia debaji, quale anke ni remisas a nia debanti; e ne duktez ni aden la tenteso, ma liberigez ni del malajo. Amen.

Bibliography.— For the general problem, consult 'Histoire de la Langue Universelle' and 'Les nouvelles Langues internationale' (par Couturat et Lau, Paris 1907); for the Delegation, 'Conclusions du Rapport sur l'etat present de la Langue internationale' (par Couturat et Lau, Paris 1907); for Ido, 'International Language and Science' (Ostwald et al., London 1910).

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IDOL, in a sense now obsolete, or nearly so, an image (Greek ειδωλον) or likeness of anything; in later and chiefly present signification, any image or likeness of a deity used or designed as an object of worship. By extension the term has also come to be applied to anything which is an object of adoration or of supreme affection or regard. The Eastern custom of making statues of highly revered religious teachers has led many to conclude that the figures of Buddha, Brahma, Vishnu, etc., are idols, subject to worship. This is an error. Max Muller says: "The religion of the Veda knows no idols. The worship of idols in India is a secondary formation." It may be questioned whether the images of various savage or half-civilized tribes, as the totem-poles of our American Indians, are strictly idols. However, they become such when the popular idea places them in the position of God and they are worshipped as deities. (See next article).

IDOLATRY, the worship of idols in any sense; in the restricted usage ordinarily observed, it is the worship of the Deity or of a deity under a visible form; and from the point of view of the Christian, or any other religion which rejects the worship of images, consists in worshipping as God what is not god. With regard to the origin and character of idolatry, there is a wide divergence of opinion. The Christian religion conceives idolatry as a declension from the one true God, sees in the various forms of heathen worship only more or less complete degradations of an original revelation and ascribes to it the same origin as to sin. Some philosophical and historical writers on the other hand see in idolatry an innate searching after God and accordingly the first stage of human development, the necessary beginning of a knowledge of God. Idolatry may assume various forms. One nation seeks its god in the powers of nature, worships the heavenly bodies and the elements and creates for itself a nature-worship; another develops a hero-worship and a third has merely an animal and image worship, the lowest form of which is fetishism (q.v.). To this last and rudest form of idolatry, that consisting in animal and image worship, the name of idolatry is sometimes confined. See IMAGE WORSHIP.

IDRIA, ē′drē-ạ, Austria, town in the Crownland of Carniola, 25 miles west of Laibach. It is important as a mining-centre for quicksilver since 1497. Since 1580 the mining has been controlled by the state, which in normal times has limited the output to an average of about 500 tons a year. The town contains a bobbin factory, a factory for electric equipment and at trade school. Pop. 16,876.

IDRISI, ĭd′rē-sē, or **EDRISI, Abu-Abdallah Mohammed,** Arabian geographer: b. about 1090; d. about 1160. He studied at the Moorish University of Cordova, traveled through various countries bordering on the Mediterranean, visited France and England and was then invited to the court of Roger II of Sicily, where he resided under the patronage of Roger and his successors till his death. He constructed at the request of Roger a terrestrial globe of silver, on which the figure of the earth was shown with as much accuracy as the state of geographical knowledge then permitted. He accompanied this with a descriptive treatise bearing the title 'Nuzhat Almushtâk,' completed about 1150. An old manuscript of this work was discovered at Paris in 1820 and published in a French translation by Jaubert. The Latin translation 'Geographia Nubiensis' (Paris 1619), is considered more reliable. Under the title of 'L'Italia,' Schiaparelli and Amasi published an Italian translation of a part of it in 1883. Two of Idrisi's original MSS. are in the Bodleian Library at Oxford and two in the Bibliotheque Nationale at Paris. Idrisi's fame grows with the years, as he appears the first to have recognized and recorded the sphericity of the earth. Consult Brockelmann, 'Geschichte du Arabischen Litteratur' (1898).

IDUMÆA. See Edom.

IDYA, a name of Britannia, long a favorite with the poets.

IDYL, or **IDYLL** (from a Greek diminutive meaning a "little form or image"), a short and highly finished descriptive poem, especially if it treats of peaceful and pastoral subjects. It is a complete picture in small compass and may refer to a great variety of subjects and is frequently pastoral because pastoral life, at once simple and picturesque, affords the best material for such short descriptive poems. The term is indefinite, even prose and pictures having been termed idyls. The 'Idyls' of Theocritus and the 'Idyls of the King' by Tennyson (1859) are conspicuous examples of the use of the term. Any one who has read these will grasp a fuller conception of what pictures in verse or prose are best entitled to be called idyls. It is an error to assume that idyl is as definite a descriptive term as epic or eclogue.

IDYLLS OF THE KING, The. 'The Idylls of the King' may be called Tennyson's greatest work because the poem occupied much of his time for all his literary life, because it presents in pictorial form ideas which in Tennyson's mind lay at the bottom of modern life and of his own thinking, and because it is expressed in the beautiful blank verse of which he was a master. "We know not of a nobler subject; we know not where to look for one who could have more nobly thought it out" wrote Dean Alford at the time of the poem's appearance. In 1833 Tennyson wrote 'Morte d'Arthur,' now a part of 'The Passing of Arthur,' and in 1859 he published 'Enid,' 'Vivien,' 'Elaine' and 'Guinevere,' poems on topics drawn from the Arthurian cycle, but apparently without thought of more unity than came from the contrast of the different characters. In 1869 these pieces were republished with several others in the form of a complete poem. Minor changes were made even as late as 1885 when 'Balin and Balan' was added. These different idylls, finally 12 in number, are grouped into one poem not only by their presentation of the same world of men and women but by their development of a single action, the rise and fall of the power of King Arthur, the legendary hero of England. In Arthur, however, Tennyson says he has in mind not the figure of ancient folk-myth, nor even the legendary hero of Geoffrey and Mallory, but a figure indicating "sense at war with soul." This symbolic under-meaning gives further unity to the poem. Arthur stands for the human soul in its strife with the evil of the world. It comes from no one knows where, is united to the body, strives, conquers and in time finds the world too much for it and passes away no one knows whither. These symbolic conceptions are most common in the poems written after the poet had conceived the general idea of his work. A minor form of unity is given by the indication of the mystical year: Arthur is born New Year's night; is married in May; the adventures of Gareth, the type of his knights, is in early spring; the quest of The Grail in full summer; the Last Tournament is in autumn; and Arthur passes from earth on the last night of the year. The poem gives a decorative panorama of the legend-cycle of King Arthur, which is the English national epic material. As each succeeding century presents the old stories in the form of its day so Tennyson's figures in the 'Idylls' are ideal conceptions of the 19th century. The blank verse in which the poem is presented is one of Tennyson's great achievements and the figured poetry is also characteristic of the poet. Not only have we true picture, but abundance of pictorial figure and pictorial suggestions. The poem has delighted the most naive story lover and the most earnest seeker after ideas in poetry. Studies of the 'Idylls' will be found in most books on Tennyson, but they are more particularly treated in the books on the 'Idylls' by H. Elsdale (1878); H. Littledale (1893); M. W. Maccullum (1894); C. B. Pallen (1904); and L. Dhaleine (1905). An authoritative and contemporary criticism is that of Dean Alford in the *Contemporary Review* (Vol. XIII, 104). This, with another, Tennyson himself considered the best reviews of the 'Idylls.' He himself did not care to have his symbolism pushed too far, chiefly because he did not like to have his very concrete poems made into a series of abstractions. He said that the "thought within the image" was more than any one interpretation. The 'Life of Tennyson' by his son (Vol. II, chap. V) gives the poet's own thoughts on his work.

Edward Everett Hale.

IDYLS OF THEOCRITUS, BION AND MOSCHUS. See Theocritus, Bion and Moschus, Idyls of.

IDZU, ē'dzoo, Japan, a province of the empire on the so-called Eastern Maritime Circuit, or Tokaido, formed of a hilly peninsula bounded on the east by the Bay of Sagami and west by the Bay of Suraga. It is about 32 miles long and about half that in width. It is traversed by the Kanogawa. The highest mountain of the peninsula is Amagisan, which rises to a height of 4,800 feet. Silkworm culture and allied industries form the chief occupation of the inhabitants. There are numerous hot springs and watering places. Mishima is the chief town and Shimoda the chief port. Consult Reim, 'Japan' (London 1884) and Satow and Hawes, 'Handbook for Travelers in Central and Northern Japan' (Yokohama 1881).

IERNE, ī-ẽr'nē, a name of Ireland (Eire, Hibernia, Juverna), found in ancient Greek writers.

IFNI, ēf'nē, Morocco, a seaport, situated opposite the Canary Islands on the west coast. Since 1883 it has belonged to Spain. Pop. 6,000.

IFUGAO, ĭ'foo-gou', a tribe of northern Luzon, Philippine Islands. They are of Malay origin, are head hunters and practise tatooing. They are noted for their expertness in agriculture, to which their rough hillsides are but ill-adapted. They have terraced the mountainsides more than any other native people and their plots are watered by an ingenious irrigation system. They are good woodcarvers and work iron and steel.

IGBARA, ēg'bą-rą, a negroid people of the Sudan. See FULAH.

IGLAU, ē'glou, Austria, town of Moravia, on the Iglawa, 55 miles northwest of Brünn, on the border of Bohemia. It contains a Rathaus, several ancient churches, military barracks and a cloth hall. It is an important industrial centre, with woolen and cloth manufactories, spinning factories, dye works, cigar factory, furniture work, tanneries, shoe factories, potteries and sugar mills. It has a good trade in the products of all these establishments and also in lumber and agricultural products. Until the Thirty Years' War it was a silver-mining centre, but in that conflict it suffered greatly, being twice occupied by the Swedes. Pop. 38,369, including about 4,000 Czechs.

IGLESIAS, José Maria, ē-glā-sē-äs, Mexican historian and publicist: b. City of Mexico, 5 Jan. 1823; d. 1891. He studied law in the University of Mexico, was appointed professor of jurisprudence there, became Secretary of Justice in 1857, and, after service as head of the Treasury Department, again held the post in 1853-67. In 1868 he was elected to Congress, in the same year was appointed Secretary of the Interior, in 1873 chosen president of the Supreme Court. After the fall of Lerdo de Tejada, he established a government which soon yielded to the superior power of Diaz. His publications include 'Apuntes para la Historia de la guerra entre Méjico los Estados Unidos' (1852); and 'Revistas históricas sobre la Intervención Francesca' (1870).

IGLESIAS, Miguel, Peruvian military officer: b. Cajamarca 1822; d. 1901. After the usual career in the army passing through the various grades he became Minister of War in 1880. In the following year during the war with Chile he made a heroic defense of Lima against the invaders. He was made prisoner, but effected his escape. He agreed to cede the southern provinces of Peru to Chile provided she would withdraw from the rest of Peru. In 1883 he became President of Peru and late the same year concluded the Treaty of Ancón with Chile. Political opposition to the treaty was very strong, however, and the party of General Caceres forced an agreement from Iglesias under which both retired pending an election. Caceres was elected and Iglesias quitted Peru.

IGLESIAS, Pablo, Spanish Socialist leader: b. Coruña, 1850. He became a printer and from his 18th year was prominent in trades union circles, which in Spain were of their very nature Socialistic. He was elected to the federal council of the Spanish International in 1871 and was a member of the staff of the Socialist paper, *La Emancipación*. In 1878 he was one of the founders of the Socialist Labor Party and subsequently served as chief of the Printers' Association and the Federation of Typographers. In 1885 he became editor of *El Socialiste*, the official organ of Spanish Socialism and for over 30 years labored strenuously to advance the position of his party. He was elected to the Cortes in 1910 and three years later became head of the Central Labor Union.

IGLESIAS, Sardinia, a southern city and episcopal see. The cathedral built by the Pisans dates back over 700 years. Mines of zinc and lead furnish the city's chief industries. Pop. of city 10,411; of commune 20,000.

IGLOO, ĭg'loo. See ESKIMO.

IGLOOLIK, Canada, a small island in the Arctic Ocean, near the east end of Fury and Hecla Strait in lat. 69° 21′ N. and long. 81° 53′ W. It is noted as the place where Parry wintered in 1822-23.

IGNACIO, ēg-nä'thē-ō, **José de Jesu María,** German Jesuit: b. Paderborn, 1721; d. 1780. His family name was Herman Loessing. After some years in the Jesuit order he was appointed professor of rhetoric and philosophy at the College of Old Mexico. For over 10 years he collected antiquities, inscriptions, etc., of the ancient inhabitants of Mexico, which he brought back with him to Europe. In 1768 he was appointed librarian to the archbishop of Cologne. His published works include 'De Arte Hieroglyphum Mexicanorum' (1774); 'Historia Novæ Hispaniæ' (1777); 'Reisen in Neu-Spanien' (1778); 'Historia Regni Aztecorum' (1780); 'Cosmographia' (1780).

IGNACIO (ēg-nä'sē-oo) **ISLANDS,** Mexico, a chain of islands in the Gulf of California, off the Bay of Topolobampo, in the state of Sinaloa. The chief are Macapule and Altamura.

IGNATIEFF, ĭg-nä'tyĕf, **Nikolai Pavlovitch,** COUNT, Russian military officer and diplomat: b. Saint Petersburg, 29 Jan. 1832; d. 1908. In 1849 he received his commission as an officer in the Guards, took part in the war in the Crimea and in 1858 reached the rank of major-general. As diplomatic representative of the tsar he concluded the Treaty of Aigun with China in 1858; was subsequently sent to Bokhara, and in 1860 was named Minister Plenipotentiary to Pekin. In 1863 he became chief of the Asiatic department of the Ministry of Foreign Affairs and from 1864 to 1877 was Russian Minister to Turkey. He did much to bring on the war of 1877 between Russia and Turkey, by fomenting agitation among the various Balkan peoples subject to the sultan. He was eclipsed for a time by his opponents but in 1881 he was appointed Minister of the Imperial Domains and later of the Interior. He persecuted the Jews relentlessly. He was dismissed from office in 1882.

IGNATIUS, ĭg-nā'shĭ-ŭs, **Father.** See LYNNE, JOSEPH LEYCESTER.

IGNATIUS OF ANTIOCH, Christian bishop and martyr: b. Syria, c. A.D. 50; d. Rome, A.D. 110-117; was called in Syriac *Nurona*; and probably received at baptism his second name, Theophorus, «the God-bearer.» Of his early life nothing is certain. Origen, 'Homil. vi in Luc., sec. 1,' speaks of him as the second bishop of Antioch after Peter. Theodoret, 'Epist. 151,' says that «Ignatius, who is known far and wide, received the high priesthood by the right hand of the great Peter.» The 'Chronicon' of Eusebius, in Saint Jerome's revision, groups Ignatius of Antioch with Papias of Hierapolis and Polycarp of Smyrna as disciples of John the Evangelist. The Martyrium Ignatii, accepted as historical by Pearson and Ussher but rejected by Lightfoot, is copious in its details of the martyrdom of Ignatius. The authentic letters of the martyr give the following account of the journey to martyrdom. Ignatius was condemned to death (Ephes. 12, Trall. 3, Rom. 4), and sent to Rome «to make a Roman holiday.» He made no appeal to Cæsar, as had Saint Paul. His chief desire is that no appeal be made in his behalf (Rom. 1, 2, 5, etc.). Likely the cause of the journey to Rome was merely the clamor of the Roman populace, during Trajan's reign, for the butchery of men as well as beasts in the arena. The martyr probably set sail from Seleucia, the port nearest to Antioch. His guard of 10 soldiers gathered in other victims as they proceeded toward Rome. The route was across Asia Minor, from a Cilician or Pamphilian port, to Philadelphia, on to Sardis, and thence to Smyrna. Here Ignatius was received by his friend Polycarp, and met by delegates from the churches of Ephesus, Tralles and Magnesia. During this stay at Smyrna, the letters to the Ephesians, the Trallians, the Magnesians and the Romans were written. The guards seem to have been a brutal set. Ignatius speaks of them as «ten leopards» (Rom. 5); and says he «has been fighting with wild beasts.» From Smyrna the prisoner was taken to Troas, where he wrote his letters to Philadelphia, to Smyrna and to Polycarp. From the letter of Polycarp to the Philippians, we learn of the martyr's stay at Philippi; and of the request made by that church for the letters of Ignatius. To this request and Polycarp's compliance, is probably due the first collection of the seven authentic Epistles of Saint Ignatius. His martyrdom is witnessed to by Origen, Homil. in Lc. vi; and is assigned by Eusebius, 'Historia Ecclesiastica, iii, 36,' to the reign of Trajan. Seven of the Epistles of Saint Ignatius are now quite generally admitted to be authentic, those to the churches of Ephesus, Magnesia, Tralles, Rome, Philadelphia, Smyrna and to Polycarp. These are the collection witnessed to by Eusebius, Saint Jerome and many later Fathers, and admitted by such critics as Lightfoot, Harnack, Zahn and Funk. Of doubtful authenticity are the letters to (1) Mary of Cassobola; (2) Hero, deacon of Antioch; to the churches of (3) Tarsus, (4) Philippi, and (5) Antioch. Admittedly spurious are two letters to John the Apostle, one to the blessed Virgin Mary, and one from her to Ignatius. The Epistle to the Romans is chiefly personal. It reveals the writer's enthusiastic devotedness, intensity of personal love for Jesus Christ and ardent yearning for martyrdom. The other six authentic letters are chiefly doctrinal. They teach the divine institution of the Church as a visible society (Philad. 3), her unity (ib., Magn. 13), holiness (Eph. 9), catholicity (Smyrn. 8), infallibility (Philad. 3), hierarchical constitution and priesthood (Magn. 13, Eph. 9), together with the primacy of the Roman see (Rom., Introd.).

Bibliography.— The best editions of the Epistles of Saint Ignatius are: Zahn (1876); Funk (1901); Lightfoot (1889); Cf. Newman, J. H., 'The Theology of Saint Ignatius,' in *Historical Sketches,* I (1890); Gasquet, 'Saint Ignatius and the Roman Primacy' in *Studies* (1904).

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IGNATIUS' BEAN. See SAINT IGNATIUS BEAN.

IGNATIUS OF LOYOLA. See LOYOLA, IGNATIUS OF.

IGNEOUS (ĭg'nē-ŭs) **ROCKS,** the term applied in geology to those rocks the special structure of which is due to their having been once in a molten state, from which they were solidified into their present character. They include lava, basalt, granite (qq.v.), etc. Such rocks are not stratified, and may occur in connection with sedimentary rocks of any age, as the igneous rocks have usually been erupted from the heated interior of the earth and forced up toward, sometimes to, the surface. A detailed classification of igneous rocks is given in the section on *Igneous Rocks* in the article on ROCKS.

IGNIS FATUUS, ĭg'nĭs făt-ū'ŭs (Latin *ignis,* fire, *fatuus,* foolish), an atmospheric light or a luminous appearance sometimes seen in swamplands, in churchyards and over stagnant waters. The light usually appears shortly after sunset; it is common in the north of Germany, in Italy, in the south and southwest of England, and the west of Scotland, and has been noticed in many other countries in undrained marshy districts.

The appearance generally resembles a flame; seen closely, the color appears as bluish, reddish, greenish or yellowish, merging into purple, but never a clear white. Sometimes the flame seems fixed in position, shining steadily close to the ground or a few feet above it; again, it appears in rapid motion, sometimes rising high in the air, at others separating into smaller flames, which are seen advancing, retiring, recombining, etc.

Some supposed appearances of the ignis fatuus are probably due to luminous insects, or to the phosphorescence of decaying vegetable matter. By setting all such possible cases aside, both fixed and moving ignes fatui have been proved to exist, although the spectrum of the light seems not to have been fully observed. The common hypothesis that ignis fatuus is the flame of burning marsh-gas, CH_4, is untenable, for although this gas is produced abundantly in many marshy places, it cannot ignite spontaneously. The more plausible suggestion that phosphoretted hydrogen, PH_3, which is spontaneously inflammable, might be produced in churchyards or marshes where there is decaying animal matter does not account for some of the effects observed. The early supposition of a phosphorescent vapor is more reasonable, although excepting that of free phosphorus, which could not occur in nature, no such vapor is known to exist. The phenomenon was undoubtedly more common a century ago than it is now, and its disappearance in many localities may be directly traced to the draining of fens and marshes.

Popular names for the ignis fatuus — Will-o'-the-Wisp, Jack-a-Lantern, Spunkie, etc.— abound in folklore, and the superstitions regarding it are connected with many stories of travelers mistaking the marsh-lights for those of cottage windows, and with tales of evil spirits decoying men into dangerous places, often to their doom.

IGNITION, in gas engines, the firing of the explosive mixture of gases — in the cylinder of the reciprocating engine; in the pressure chamber of the rotary engine. In the earliest types of gas engine ignition was accomplished by an outside flame kept burning before a slide door, which was opened when the cylinder had been charged. After compression of the gases was introduced, the ignition was secured by a platinum tube projecting into the cylinder, and heated red-hot by an outside flame blown into it. In the modern gas engines ignition is accomplished by a "fat" electric spark, produced either by a battery, a magneto, or a small dynamo. There are two systems of electrical ignition: the "jump-spark," or high tension system; and the "make-and-break" or low tension system. In the first, the electric current is taken into the cylinder through a "plug," at the inner extremity of which is a break, or "gap" in the continuity of the metal conductor, across which gap the current is forced to leap. This gap ranges in width from one-third inch where a coil is used in the circuit, to one-sixty-fourth inch where there is no coil. The fact that the explosion of the gaseous mixture is not actually instantaneous, but requires an appreciable time, has led to the use of two sparking plugs in cylinders of large capacity. In this case one of the plugs is a double pole member, and the firing current is sent first through this, going afterward through the ordinary plug. A gain of power ranging as high as 30 per cent has been noted as a result of this double firing.

The make-and-break system is in use chiefly in small marine or motorboat engines. Within the cylinder are two polar extremities of the battery conductor, and one of these is moved by a mechanism outside of the cylinder, so as to make contact with the other, and this contact is immediately and suddenly broken, when a spark is produced. This method does not require as strong a current as that necessary to make the leap across the gap in the spark plug, but with a coil in the circuit the spark is big enough and hot enough to be entirely dependable. See AIRPLANE ENGINE; AUTOMOBILE ENGINE; INTERNAL COMBUSTION ENGINE.

IGNITION SYSTEMS. See INTERNAL COMBUSTION ENGINE.

IGNORANCE OF THE LAW. Every person is presumed to know the laws of his own country, and what is termed ignorance of the law is a lack of understanding of those laws. Such want of understanding furnishes no excuse for their violation and cannot be pleaded even in extenuation of their infraction. But this presumption does not extend to the municipal laws of countries or states other than that in which a person resides. Such laws are regarded as foreign and a knowledge of them on the part of one who disregards them must be established by proof in the same manner as any other facts are proved. This applies only to a non-resident of such foreign state, and as soon as a person becomes even a temporary resident thereof he is presumed to know its laws and to yield obedience to them. He cannot plead his want of opportunity to become acquainted with them.

IGNORANTINES (*Fratres Ignorantiæ*). See BROTHERS OF THE CHRISTIAN SCHOOLS.

IGOROT, ē'gō-rōt, the inhabitants of the districts of Bontoc, Benguet, Lepanto and Amburayan of northern Luzon. They live by agriculture and practise irrigation. Their dwellings are always found in groups and are roofed with grass or huge leaves. The Bontocs are head hunters. The total number of Igorots is placed at 211,500. Consult Jenks, 'The Bontoc Igorot' (Manila 1905). See PHILIPPINE ISLANDS.

IGOR'S (ē'gôrz) **MARCH, Song of,** an antique battle song, associated with the name of Igor, Prince of Novgorod, son of Prince Swajatoslaw II of Tchernigof. Igor in his 51st year is recorded to have engaged in an unsuccessful war with his neighbors (1202), and from that time has been looked upon as the national poet of old Russia, on account of a lyrical epic poem, or ballad, called in Russian, 'Slavo o Polku Igoreve' ('The Song of Igor's March'). It has come down to modern times, somewhat like the songs of Ossian. The poem was probably produced by one of the followers of Igor, and in 1795 was found by Count Alexis Mussin-Putchkin in a cell of a monastery in Jaroslav. It was discovered among some 14th century MSS., and was first published by the Count at Moscow in 1800. The original was lost in the fire of the Napoleonic campaign (1812), which destroyed the Count's fine library. Another copy with many variants was found in 1864 among the papers of Catharine II and published at Saint Petersburg the same year. It has been translated into several European langauges. Consult Wolfsohn, 'Schönwissenschaftliche Litteratur der Russen' (1843); Wjasemski, 'Bemerkungen zum Igorlied' (1875).

IGUALA, or IGUALA DE ITURBIDE, ē-gwä'lä dä ē'toor-bē'dä, Mexico, town of the state of Guerrero. It is the largest town of Guerrero and is located in a thriving agricultural region, also remarkable for its silver mines, which have been worked from the earliest days after the advent of the Spaniards. Here on 24 Feb. 1821 Iturbide announced the Plan of the Three Guarantees, known also as the Plan of Iguala. The town was severely shaken by an earthquake in 1907. Pop. 8,195.

IGUALADA, ē'gwä-lä'dä, Spain, city in the province of Barcelona, on the Noya, 45 miles northwest of Barcelona. It is located in a mountainous region, but the surrounding land is fertlie nevertheless. It is surrounded by the ruins of its ancient walls, being once a strongly fortified place. The Benedictine monastery of Montserrat is in the neighborhood. Cotton, linen and other cloths are manufactured in considerable quantities. Pop. 11,754.

IGUANA, ĭ-gwä'nä, a large lizard of the typical genus of the family *Iguanidæ*. This family is distinguished by having pleurodont teeth, a thick, villous, nearly immobile tongue, a round pupil and by various skeletal characters. The 350 species belong to about 50 genera and, with the exception of a few in the Fiji Islands and Madagascar, are confined to America, in the warm parts of which they fairly swarm. Only one species (*Sceloporus undulatus*) reaches as far north as the Middle States. They vary greatly in appearance and habits; most are arboreal, many terrestrial, and one, the Galapagos *Amblyrhynchus*, is even marine; the majority eat insects, but some are herbivorous. The true iguanas, of which *I. tuberculata* is the best known, are rather widely distributed through the West Indies, Central and

South America. Owing to the high crest or fringe which extends along the back and tail, the deep, fringed, gular pouch, and the loose-fitting skin, these animals present a remarkable appearance. The trunk and tail are covered with small granule-like scales, and the head with larger plate-like ones; the feet are large and powerful; the tail very long, slender and compressed; and the teeth high and finely serrated. A length of five feet or more is commonly attained. The iguanas are arboreal, their mottled green color serving admirably to conceal them among the foliage; but when alarmed they have the habit, remarkable in a lizard, of retreating into the water of the streams along which they live. The 20 or 30 large eggs are deposited in a burrow usually dug in the bank of a stream or sometimes in a hollow tree. Notwithstanding its formidable size and aspect, the iguana is a timid, harmless creature, and the stories sometimes told of its ferocity are pure fabrications; moreover, it is purely vegetarian in its diet. The flesh is a favorite article of food with the natives, and many travelers have pronounced it to be white, tender and sweet, and is regularly brought to the markets. Consult Wallace, Müller, Bates, Belt, Gosse and other authorities on South and Central America. See Lizard.

IGUANODON, a dinosaur (q.v.).

IGUAZÚ, ē′gwą-soo′, a river of Brazil, which takes its rise in Paraná, near the Atlantic seaboard and flows in a general westward direction for nearly 800 miles to its junction with the Paraná. For part of its course it separates the states of Paraná and Santa Catharina, and also Brazil from Argentina. Its lower course is broken by rapids and falls which render navigation impossible; among these are the great Falls of Iguazú, among the finest in the world. For long stretches of its middle course the river is navigable. Consult Bernárdez, Manuel, ‘De Buenos Aires al Iguazú’ (2d ed., Buenos Aires 1901).

IGUVIUM. See Eugubine Tables.

IHRE, ē′rĕ, **Johan**, Swedish philologist: b. Lund 1707; d. 1780. He received his education at the University of Upsala; subsequently made extensive travels in France and England, and, became assistant librarian to the Swedish Academy of Science. In 1748 he was made professor of *belles-lettres* and political economy. The government gave him $10,000 to compile his great work, the ‘Glossarium Suiogothicum’ (1769), which laid the foundation of Swedish philology. Many other works of his are extant, worthy in the form of academic disputations. The most valuable are those dealing with the gospels of Ulfilas.

II KAMON NO KAMI NAOSUKE, ēē-ēē käh-mōnē nō kă-mēē, näh-wō-sŏŏ-kēē, the Japanese statesman who succeeded in opening Japan to foreign trade and residence; b. 30 Nov. 1815; d. 24 March 1860. Descended from ancestors (987–1011), who served the Mikado in subduing the Ainu aborigines. At 27, Ii was made the 14th lord of Ii-dani (valley of Ii), whose predecessors occupied a castle in the fief assigned Iyeyasu (q.v.). On 25 Dec. 1850, he was given the title of lord of Hokoné, and on 4 June 1858, when the American envoy Townsend Harris (q.v.) was pressing the Yedo government for a commercial treaty, at a time when internal politics were in turmoil, the shogun, a boy, and the Yedo and feudal systems decadent, Ii was made premier. Although the Mikado Komêi, and the Imperial Court at Kioto violently opposed the idea, the Lord Ii, with the example of India and China before him — the French and British fleets being then in the neighboring Chinese waters — took the responsibility and signed the American treaty, which was soon followed by others, with Europeans. With an iron hand, wielding the jailer's and the executioner's sword and without regard to name or rank, Ii overcame his most active opponents. He dispatched an embassy to the United States in the United States steamship *Powhatan* which, after arrival, made the tour of the American cities, being everywhere warmly welcomed and sumptuously entertained. On 4 March 1860, while on his way to the castle in a snow storm, a band of 18 ronin (q.v.) attacked his train. In the bloody battle that ensued, Baron Ii was beheaded and 29 men were killed or wounded. After a generation of obloquy and misrepresentation, Ii's name came to be held in universal popular reverence. The intensely strong opposition of the devotees of ultramikadoism long prevented a proper memorial to Ii from being reared in Tokio, where it should be; but in Yokohama a noble monument has been reared in his honor. His son was educated in Brooklyn, N. Y. Consult Alcock ‘Capital of the Tycoon’ (1863); Satoh, ‘Agitated Japan: The Life of Baron Ii’ (1896); Griffis, ‘Townsend Harris’ (1906), and, in fiction, Maclay, ‘Mito Yashiki’ (1889).

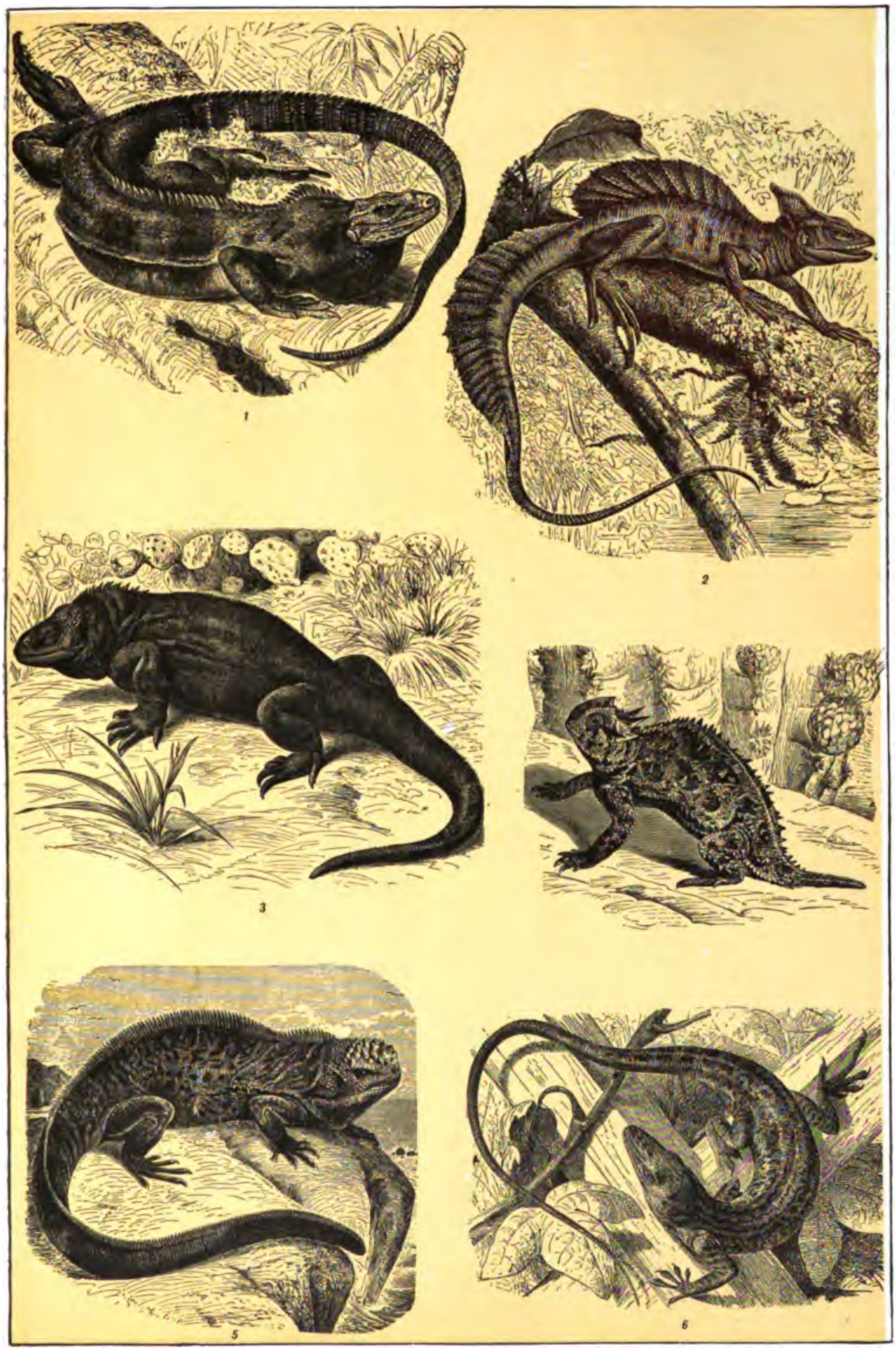
IK MARVEL. See Mitchell, D. G.

IKAO, ē-kă′ō, Japan, a summer resort in the province of Kotsuke, 88 miles from Tokio. It is located on the slope of Mount Haruna and contains several hot springs to which great numbers resort for curative purposes.

IKUNO, ē-koo′nō, Japan, town in the prefecture of Hyogo, 35 miles northwest of Kobe. It is situated in a great silver-mining region, the mines being a government monopoly. Day and night shifts are employed. Some gold is also produced. Pop. 3,000.

IL CORTEGIANO. ‘The Cortegiano’ of Baldassare Castiglione (1528) deals with the «formation of the perfect courtier.» The author represents these dialogues as a social «game» actually played at the court of Urbino, presided over by the Petrarchistic genius of Cardinal Pietro Bembo and reckoned as the most elegant centre of fashion in Italy at that time. ‘The Cortegiano’ thus gives striking and authoritative portraits of leading personalities of the Italian Renaissance, and its vivid picture of society ranks, for scope and reliability, above the prefaces to Bandello's tales and even above the autobiography of Cellini. In central intent the volume has a narrow purpose: it is the handbook of the professional court gentleman, hard to distinguish from the perennial Italian adventurer. No inconsiderable portion of the maxims of Castiglione reflect that hard-headed materialism made so famous by Machiavelli in sociology and political theory. Castiglione is as free from delusions about human nature as the great Florentine secretary. He is equally expert in the psychology of malice. ‘The Cortegiano’ like ‘The Prince’ places sagacity above

LIZARDS



REPRESENTATIVE IGUANID LIZARDS

1 Ring-tailed Iguana (Cyclura carinata)
2 Helmeted Basilisk (Basilicus americanus)
3 Galapagos Land-lizard (Conolophus subcristatus)
4 Horned-toad Lizard (Phrynosoma cornutum)
5 Galapagos Sea-lizard (Amblyrhynchus cristatus)
6 Red-throated Anolis (Anolis carolinensis)

other virtues. The courtier's business is to succeed in life, not by good intentions, but by a triumph of wits. But upon this aspect of Castiglione's ethics, so typical of his race and period, the vast public which 'The Cortegiano' has reached through the centuries has been loath to linger. In a broader sense the «perfect courtier» has been taken as the model for any gentleman of the leisure class. The Italian tyrannies, in fact, of the early 16th century, reached the perfection of Italian social life at a time when Italy, assimilating the best that French and especially Spanish chivalry had to offer, was leading the world in good manners and setting to a large extent the standards of cultivated elegance that have ever since prevailed. 'The Cortegiano' is the code book of this refinement, less naïvely detailed than the 'Galateo' of Cardinal della Casa, but far more profound in theory; and specific enough in precept, as Castiglione elaborates his sound general premise that the fundamental problem of good form is to acquire a «sense of other people,» to strike a just balance between self-assertion and regard for others. What most engages in Castiglione, aside from his personal traits of urbane composure, a kindly, good-humored and deferential condescension, is the passion for «fullness of life» both in action and in cultural attainment. His interlocutors frequently stand aghast at the demands they make on the ideal gentleman, and his partner, the ideal lady (Book III). The courtier must be expert in arms and statecraft, learned in «the two languages,» a scholar and writer in his own tongue, accomplished, at least as connoisseur, in the fine arts, with some skill in music and a flawless training in dancing, games of chance and skill, hunting, athletics, as well, of course, as in conversation for all situations and people, in etiquette and the art of dress. Never was a book on manners so nobly and liberally conceived. For Castiglione would have his courtier incarnate the highest moral ideals and express the widest culture of his environment. In its review of the ethical, philosophical and æsthetic problems that preoccupied the cultivated people of its time, 'The Cortegiano' possesses an additional and very special interest, as reflecting the astounding general culture of the aristocrats of the Italian Renaissance. Among these discussions we may signalize the comparison of painting and sculpture (I), the richly illustrated analysis and classification of types of humor (II), the development of the «courtly» theory of the Italian national language, historically important (I), and the theory of contraries applied to social criticism (II). But decidedly the most famous portion of the book is the treatise on Platonic love put into the mouth of Bembo, himself the author of Platonic dialogues entitled 'Gli Asolani.' This theory of love is really a theory of knowledge: by love of the good and beautiful in woman or in man, we are brought to know and love the good and beautiful in universal divine forms. This «philosophy» of love may have a certain scientific basis in the relations of the religious and sexual instincts. But as a social fad, persistent through all the old régime, it was never more than a justification and a pretext for sensualistic idling and an excuse from serious thought on woman's status in society; though it did say many beautiful things on love and woman and created a phraseology suggesting certain humane ideals. 'The Cortegiano' did as much as any other one book to spread these Platonic notions and remains one of the most typical expositions of this kind of pseudo-thought.

ARTHUR LIVINGSTON.

IL PÆSE DI CUCCAGNA. See PÆSE DI CUCCAGNA.

IL PASTOR FIDO. With the 'Aminta' of Tasso the 'Pastor Fido' of Battista Guarini (1538–1612) is associated as closely in the mind of posterity as their authors were associated in friendship and in the service of the House of Este at Ferrara. The success of the 'Aminta' was, in fact, Guarini's inspiration for writing his famous pastoral drama, which, if it never obscured the glory of its delicate predecessor, at least came to enjoy a fame just as wide and an authority even more unquestioned by the theorists of style and dramatic poetry in the following century. The success of the 'Pastor Fido' in this latter respect realized the author's predominant purpose in composing it. Guarini belongs to the age before him in his acceptance of the canons of Aristotelian poetics. He belongs to the age after him in the sense that he tried to criticize those canons, by demonstrating that the «kinds» of poetry recognized by the earlier criticism were not the only ones, and that other new ones could be invented though the inventor still remained faithful to the fundamental and unalterable principles of poetic imitation laid down by Aristotle. In its conception, thus, the 'Pastor Fido' was a work of ingenuity, aimed at proving that the tragic and comic elements, separated by Aristotle, could be «legally» blended in a new «species» of art to which the name «tragi-comedy» came to be applied. There is nothing remarkable, historically, about such a literary ambition. Poets before Guarini's time wrote dramas and epics to prove that the rules illustrated in the great classical poems could be applied to works in the modern national languages. Those of his day and after him went farther, and after discovering the new «genres» in theory each tried also to compose the enduring masterpiece which would illustrate the new laws and become the model for all successive imitations. The main obstacle to success in such attempts was the envy of competing poets. The 'Pastor Fido' made its way to the longed-for goal only after polemics which lasted for several decades, though the author enjoyed the unusual lot of surviving them and in his own life time witnessing the canonization of his poem.

What makes these old literary quarrels uninteresting now is that they view «plot» as the principal subject for discussion. They throw no light on what are now regarded as true literary values. Even Guarini's treatment of the 'Pastor Fido' itself, called by him the 'Handbook of Tragi-comedy,' has little value as an æsthetic interpretation. In the history of dramatic technique, considered from the modern point of view, the 'Pastor Fido' would be classified as a play of the strict Italian Renaissance tradition; the action is of little importance genetically. Faithful to the method of the Greeks, its dramatic method is to contemplate lyrically the psychological effects of the action, which is not produced by the psychological traits of the characters. As was true of the

‘Aminta,’ however, we may say of the ‘Pastor Fido’ that the sources of its interest to erudites is not the source of its permanence among the great works of literature. This is due, rather, to its intensified development of one of the traits of Tasso's play: its passionate sensuousness, gracefully veiled, and resting on a humor, equally delicate, which comes much less from the consciously comic element than from the playful mechanical nature of the whole world with which the pastoral deals. This trait endeared it to the idle and elegant aristocratic courts of the old régime. To it also people of the present time occasionally revert for a sip of that honeyed, melancholy and sophisticated refinement of licentious gallantry which passed away with the old world, as a fashion, though its moods are part of all human nature.

A very just appreciation of the ‘Pastor Fido’ may be found in Mr. Boulting's ‘Life of Tasso.’ There is a translation by Fanshaw (London 1676).

ARTHUR LIVINGSTON.

IL PENSEROSO. Some general remarks on ‘Il Penseroso’ will be found in the article on the companion poem ‘L'Allegro’ (q.v.). ‘Il Penseroso’ presents the contemplative or thoughtful mood or humor. We need not think of these sketches of mood or humor as representing different people; Milton probably recognized them both in himself, as many others may do. If he did, we must remember that the contemplative mood grew upon him with years and, indeed, was more nearly his real self. The poem begins by getting rid of «vain deluding joys.» We need not think of these as the joys of the cheerful, active life celebrated in ‘L'Allegro’; they are rather the extravagance of the active humor, just as the «loathed Melancholy» of ‘L'Allegro’ is not the contemplative mood expressed in the other poem, but an exaggeration or perversion of it. Next comes the address to the «Goddess sage and holy» whom he calls «divinest Melancholy.» One reason for thinking that we have here the truly Miltonic mood is that this part of the poem is longer than the corresponding part in ‘L'Allegro’; the poet has more to say, just as he has later in the poem. The thoughtful mood is accompanied by Peace, Quiet, Leisure, Contemplation. Then Milton gives an idea of the day's occupation; it is mostly taken up in reading and study, begun after the evening's walk and carried on far into the night, or even to the cloudy morning. By day the meditative man walks in the quiet grove or the studious cloister. In this poem Milton looks ahead, as he does not in ‘L'Allegro’ and sees the quiet and retired end of life, in which experience and wisdom have matured into something like the voice of God. As is noted of ‘L'Allegro’ the poem is an example of the classic or literary poetry, especially as thought of in the 17th century. The classic form and mythology together with the rather conventional idea make it seem old-fashioned to us. But it has the power and virtue of the true classic; it is always pleasing, never losing its power to appeal to the heart and mind. For editions see L'ALLEGRO.

EDWARD E. HALE.

IL PIACERE. See PIACERE.

IL SIGNOR IO. A tale rather than a novel, slight in form and in plot, ‘Il signor Io’ (‘Mr. Myself,’ 1882), by Salvatore Farina, is one of the finest works of the Milanese novelist. Lit up by a gentle yet sympathetic humor, partaking both of the caricature of Dickens and the playful tenderness of Goldsmith, no more delightful picture of the petty domestic tyrant and unconscious egoist can be imagined than this Italian professor of philosophy, Marco Antonio Abate, whose love of creature comfort sacrifices first his wife and then his daughter to his gentle despotism. The first part of the novel is autobiographical. With a bland, almost childlike artlessness, Marcantonio's diary betrays his selfishness in unconscious self-indictment, a masterly portrayal of his egoism. In the subsequent part of the story, the lonesome father (his daughter long since driven from his heart and home) seeks solace in remarriage. With an unctuous humor the author shows Marcantonio under the assumed name of «Mr. I. O.» advertising for a wife, alternately hoping and despairing as the replies come in, one of which by a trick on the part of the son-in-law brings about the reconciliation so inevitable in Farina's novels.

A past master in the portrayal of the petty incidents of domestic life, an artist in the treatment of simple characters, a great admirer of family ties and children, a writer possessing a graceful and charming style, Farina in the kindly optimism of ‘Il signor Io’ has succeeded in uniting the technical execution of the realist to the tenderness of the idealist. In Marcantonio he has depicted an ingratiating character, a sympathetic figure despite all his defects, lovable because so essentially human. Consult Croce, B., in *La Critica* (Vol. IV, 1906); Marc-Monnier, ‘Un humoriste italien,’ in *La Revue des Deux-Mondes* (Paris 1882, pp. 405–438); *The Scottish Review* (Vol. X, 1887, with a translation of some extracts, pp. 235–266).

ALFRED G. PANARONI.

ILES, George, American author: b. Gibraltar, 20 June 1852. He received a secondary education in Montreal and from 1887 was employed in literary work in New York. His original works include ‘A Class in Geometry-Lessons in Observation and Experiment’ (1894); ‘Flame, Electricity and the Camera’ (1900); ‘Inventors at Work’ (1906); ‘Leading American Inventors’ (1912). He also edited ‘The Reader's Guide on Economic, Social and Political Science’ (1891; with R. R. Bowker); ‘A List of Books for Girls and Women and their Clubs’ (1895; with A. H. Leypoldt); and ‘A Bibliography of Fine Art’ (1897), and gave $10,000 to the American Library Association to defray the cost of ‘The Literature of American History’ (1902), a bibliographical guide which appeared under the direction of the publishing board of the association. He subsequently edited ‘Little Masterpieces of Science’ (6 vols., 1902); ‘Little Masterpieces of Autobiography’ (6 vols., 1908).

ILEX, a tree often mentioned in the Latin classics, the evergreen oak or holly (*Quercus ilex*). See AQUIFOLIACEÆ.

ILFRACOMBE, ĭl'fra-kōm, England, a seaport and fashionable health resort in North Devon, on the Bristol Channel, 14 miles northwest of Barnstable. It has a fine harbor and promenade and the town, built in terraces on a hill, is noted for its picturesque situation and the beauty of the surrounding scenery. Pop. 8,935.

ILI, il'ē, a river of central Asia, flowing partly in China and partly in Russia. It takes its rise in the Tian-shan Mountains in Dzungaria, flows west and northwest and empties into Lake Balkash by several mouths after a course of about 700 miles, about half of which is navigable. In its upper course it is called the Tekes.

ILIAD. Homer, as Horace says in the 'Ars Poetica,' does not begin the tale of Troy with the egg of Leda; that is, he does not frame his tale in a complete handbook of Greek mythology, but plunges into the midst of things and hastens to the event. Similarly a modern epitomizer must proceed at once to the story of the 'Iliad.' The real siege of Troy may have been a contest for the trade of the East and not an expedition to recover the beautiful Helen of Sparta, daughter of Zeus, wife of Menelaus, and sister of Castor and Pollux (consult Leaf, Walter, 'Homer and History'). But the conjectures of modern scholarship add nothing to the story as told by Homer and by the excavations on the hill of Hissarlik.

The Iliad conforms to Aristotle's prescription that an epic poem should not be a chronicle or a biography (as e.g., 'The Life and Death of Jason'), but a unified action. The 'Iliad' by its title is the poem of Ilium, the poem of the siege of Troy. But the first word *menis*, wrath, indicates the unity of the real subject — the quarrel of Achilles with his overlord, the commander-in-chief, Agamemnon, and its fateful consequences for the course of the war and for Achilles himself. A few words suffice for the essential plot. In the 10th year of the siege Achilles in the assembly takes the part of the soothsayer Calchas who announces that Apollo has sent a pestilence upon the Greeks because Agamemnon has refused to return to her father, the priest Chryses, the girl Chryseis, his prize from the spoils of a captured Trojan town. After a fierce altercation, Agamemnon sullenly renounces Chryseis but threatens in revenge that he will deprive Achilles of the girl Briseis whom Achilles deeply loved although she was the captive of his spear. Achilles does not overtly resist the authority of the overlord, but when Briseis is taken from him he renounces his allegiance and remains in his tent (hut), eating his heart, aloof from the war. His mother, the sea goddess Thetis, hears his laments, rises from the sea, learns the story of his wrongs, and appeals to Zeus to punish Agamemnon by bringing defeat upon the Greeks in the absence of Achilles. Zeus, unable to resist the appeal of Thetis, who clasps his knees and reminds him of former benefits, gives the promise and confirms it by the nod of his head which in Homer's sublime description was the inspiration of Pheidias' colossal statue of the god at Olympia. The first book closes with a description of the assembled gods on Olympus in which the jealous spouse of Zeus, Hera, taunts him with his concession to Thetis, and her son, the lame Hephæstus (Vulcan), plays the rôle of peacemaker and provokes unextinguishable "Homeric" laughter by assuming the function of Hebe, the beautiful maiden cupbearer of the gods.

The subsequent action of the poem shows how when the promise of Zeus has been fulfilled, when the Greeks are driven back to their camp upon the shore, and Hector is firing their ships, Achilles so far relents as to send forth to the battle his dearest friend Patroclus at the head of his Myrmidons. Patroclus is slain by Hector, and in a frenzy of passion and grief Achilles hurls himself into the war, does terrible execution upon the Trojans, and after pursuing Hector thrice about the walls of Troy kills him in single combat. The ransom of the body of Hector by his father Priam, his burial, and the lamentations of Andromache, Hecuba and Helen for the chief defender of Troy conclude the episode and the action of the poem, which occupies about 45 days.

If rigidly restricted to this outline the poem would be a *menis* or song of the wrath, an Achilleis or story of Achilles. It is an Iliad, an episode of the Trojan War built up about the unity of this central action. The broader compass is made possible by the retardation of the main action, the fulfilment of Zeus' promise, and the filling up of this time with episodes that familiarize us with the leading personages on either side, display the prowess of other Greek chieftains, yet reveal their inadequacy to supply the lack of the invincible Achilles, and heighten the dramatic suspense and deepen the moral lesson of the poem by portraying Achilles' implacable and eloquent rejection of a last despairing appeal of the Greek chieftains. As an exercise in the abstract logic of plot construction, it is possible to extract from the 'Iliad' a swifter moving story of Achilles that omits some or all of these things and narrates the wrath and nothing but the wrath. It would not be nearly so good a poem as the present 'Iliad,' and there is not an atom of evidence that it ever existed. Retardation and digression in reasonable measure have always been devices of the story teller's art, and there are no great poems and few great novels in the world that attempt to obey the prescriptions of Poe's undeviating logic of the short story.

In the 'Iliad' as we have it, digression, retardation or preparation fill the greater part of Books II–XI. Book II exhibits a debate in the assembly on the continuation of the war, a march out for battle, and a muster roll of the forces, the 'Catalogue of Ships,' a sort of domesday book of early Greece. In Book III a truce is arranged, and the issue is staked upon a single combat between Paris, the author of the war, and the injured husband, Menelaus. Helen and King Priam survey the Greek army from the walls of Troy and Helen's description introduces to us many of the leading personages of the poem. In the 4th book the breaking of the truce by the Trojans is distinctly interpreted by the poet as insuring the moral superiority and the ultimate triumph of the Greek cause. The exploits of Diomede and the confused fighting of the 5th book may seem a mere digression to modern readers, but would not offend hearers who are interested in Diomede and who enjoy vivid descriptions of fighting for its own sake. Diomede's success provides a fairly plausible motive for Hector's return to Troy in the 6th book to invoke the aid of Athena, guardian of the city. And this gives occasion for the meeting with his wife and the exquisite episode known as the parting of Hector and Andromache. Like the scene of Priam and Helen on the wall this may be justified as a device of poetic perspective. The poet had to bring within the action of 45 days whatever scenes were needful for our intelligence of the story or to make it impressive to our feeling. The subsequent fortunes of Hector in the battle interest us infinitely more after we have seen him

> Kiss his child and tossing high in air
> Thus to the gods prefer a father's prayer,

and have overheard the ineffable tenderness and patriotic resignation of his farewell to his wife.

Hector's return to the battlefield is marked by what strict logic regards as a superfluous replica of the duel between Paris and Menelaus — a similar single combat between Hector and Ajax, the mightiest Greek champion in the absence of Achilles. The general course of the fighting in books VII and VIII finally goes against the Greeks, who at the end of the 7th book build a wall to protect their camp, another instance perhaps of the unavoidable license of poetic perspective. All this prepares and supplies a motive for the episode of the 9th book, the embassy of Ajax, Odysseus and old Phœnix to offer atonement to Achilles on the part of Agamemnon and implore him to come to the rescue of his old companions in arms. Achilles' refusal was thought by Gladstone to be the finest speech in the world. Together with the parting of Hector and Andromache it should be meditated by critics who really believe that our enlightened age can feel only an historical curiosity about the rude and primitive art of Homer.

The 10th book relates how on the same night Odysseus and Diomede capture and kill the Trojan spy Dolon, and surprising the Trojan camp slay the newly arrived ally Rhesus, king of the Thracians, and drive away his white steeds. At the beginning of the 11th book the dawn of the 26th day ushers in a long and confused battle which lasts to the end of the 18th book. Near the end of the 11th book Achilles standing at the stern of his great ship observes the retreat of the Greek wounded, exults over their desperate need of him in language that literal minded critics have deemed incompatible with Agamemnon's offer of atonement in the 9th book, and dispatches Patroclus to learn the course of the battle. Various delays detain Patroclus in conversation with prolix old Nestor or in attendance on a wounded friend until after many alternations the battle goes against the Greeks and Ajax makes a last stand against Hector endeavoring to fire the ships. Then at the end of the 15th book Patroclus hastens back, and with his reproachful appeal to Achilles at the beginning of the 16th book we enter into the main current of the dramatic action that moves swiftly to the tragic dénouement. The descriptions of the fighting in books XI to XV may be said to be strung together on the thread of Patroclus' mission, and are relieved by vicissitudes of fortune, splendid exploits such as Hector's first breach in the Grecian wall (end of Book XII) and the mythological machinery (in Book XIV) of Hera's seduction and beguilement of Zeus in order to give Poseidon opportunity to aid the Trojans.

In the 16th book Patroclus clothed in the armor of Achilles goes forth to battle at the head of the Myrmidons, and after slaying the great Lycian champion, Sarpedon, is himself killed and stripped of Achilles' arms by Hector whose death he foretells as he dies. Another book of fighting, the 17th, recounts the contest for the corpse of Patroclus and the exploits of Menelaus. The 18th book tells — in Mrs. Browning's words —

> How Achilles at the portal
> Of the tent heard footsteps nigh,
> And his strong heart half immortal
> Met the *Keitai* [he lies dead] with a cry.

His lamentations as in the 1st book call his goddess mother from the sea. She promises to procure him new armor from Hephæstus, and meanwhile he steps unarmed to the trench and shouts so terribly that the Trojans give way and the Greeks recover the body of Patroclus. This is one of the two passages that Tennyson selected for experimental translation. The other is the description or simile of the shepherds in the moonlight at the end of the 8th book — in which Pope's translation so conspicuously failed and which is often used by critics to test the merits of new translations. The last 200 lines of the 18th book are occupied by a description of the scenes of Homeric life depicted by Hephæstus' art on Achilles' shield — a wedding, a trial for homicide, a siege and an ambuscade and a battle, a harvest scene, a vintage scene, a fight with lions attacking a herd, a dance.

The 19th book contains the formal renunciation of Achilles' wrath, his somewhat indifferent reconciliation with Agamemnon, the return of Briseis, the preparations for another battle, and the final picture of Achilles driving forth in his car in all the terrors of the divine armor. The fighting of the 20th and 21st books, though relieved by some magnificent passages, does not quite meet the expectations of modern readers. The battle between the gods who descend to the Trojan plain was perhaps not taken altogether seriously by Homer. And Achilles' contest with the river god Scamander and his rescue from the pursuing waters by the fire god Hephæstus are fantasies in which the proportion of allegory is not easy to determine. The climax of the 22d book, however, in which Hector is slain, leaves nothing to be desired in natural pathos of human feeling, dramatic intensity and firmness of artistic composition. This is the book selected in Jebb's 'Homer' for analysis as an illustration of Homer's style. When the Trojans are driven within their walls, Hector, whose overconfidence has been the chief cause of the disastrous rout, feels in honor bound to redeem his previous boast that he would not flinch from confronting Achilles' self. In spite of the piteous appeals of father and mother he remains without the gates, and though in a moment of uncontrollable panic he flees thrice around the sacred walls he had kept so well, he at last makes a brave stand and accepts the doom which he half foresaw when he parted from Andromache. Some modern critics have held that the poem should properly end with this climax. That was not the feeling of the Greeks nor apparently of Homer. Andromache's lament for Hector concludes the 22d book on a note of pathos which it would be impossible to sustain. The art of the poet, therefore, interposes in the 23d book the relief of the long and interesting and sometimes slightly humorous description of the funeral games which Achilles held in honor of Patroclus. In the 24th and last book we return to Hector, whose dead body Achilles maltreats, to the indignation of the gods, who arrange for its ransom. Priam, guided through the night by Hermes, finds his way to the hut of Achilles and endures what no mortal man hath ever borne, to put to his lips the hands that slew his son. In a scene of unequalled pathos the two, bethinking them of their dead, mingle their tears. Priam returns to Troy with the body of his son; and the beautiful threnodies of Andromache the wife, of Hecuba the mother, and of the guilty Helen, who now has no one left to say a kind word to her in all broad Troy, conclude the poem. As a late Greek epigrammatist writes:

> Hector whom Homer sings to every age,
> The sole support of Ilium's god-built walls,
> Thy funeral sealeth that immortal page;
> The rest is silence when great Hector falls.

The appetite of unspoiled childhood will always relish Homer whether as the older generations did in the rhetorical rhyme of Pope or as is the present fashion in the Biblical prose of Lang, Leaf and Myers. But the sophisticated taste and the distracted attention of the adult reader can recover this freshness of appreciation only by an effort. The effort is well worth making.

Of course regarded merely as documents the Homeric poems repay study. «The multitude of things in Homer is wonderful,» says an older English critic. There are few books in the world that depict a life, a stage of civilization, so completely and so vividly as do the Homeric poems. And this interest is now doubled by the possibility of comparison with the immense array of facts brought to light by the excavations of Troy, Mycenæ, Tiryns, Orchomenus and in Crete, and the enormous literature of speculation that has grown up about them.

There are greater obstacles to the unfeigned enjoyment of the ‹Iliad› as poetry. Some conception of the beauty that unavoidably escapes in translation can be gained only by the comparison of several translations, by the use of such imitations as Matthew Arnold's ‹Sohrab and Rustum› and by the study of such appreciations as Arnold's essay on translating Homer, the introduction to Pope's translation. Mackail's lectures on Greek poetry, Jebb's ‹Homer› and his ‹Lectures on Greek Poetry,› and the too few pages of literary criticism in Professor Murray's fascinating but fantastic ‹Rise of the Greek Epic.› Any one of these taken by itself and too absolutely may mislead. Arnold's ‹Sohrab and Rustum,› for example, will give nothing of the divine energy of Homer or of that rapidity of movement which Arnold himself says is the chief note of the Homeric style. It will merely help us to appreciate certain qualities of Homeric imagery, the elaborate Homeric simile turning on one slight, but sharply defined, point of resemblance. Chapman's ‹Homer,› to which Keats' sonnet has sent many readers destined to disappointment, in its most inspired passages reproduces as no other version can the fiery passion, the intensity, the impetus of Homer's battle fury. But the harmony, the grace, the reasonableness of Homer's sustained art are lacking, and for continuous perusal even the polished declamatory rhetoric of Pope will serve many readers better than the intolerable ruggedness and the un-Homeric conceits of the Elizabethan. Readers who cannot be at the pains thus to employ many aids in recovering something of the spell of the original may at least clear their minds of the conventional cavils of modernistic cant. If the excess of fighting wearies them, they are no more required to read the ‹Iliad› through continuously than so to read the ‹Faerie Queen› or ‹Paradise Lost.› Having the main story in mind they may read in various versions the speeches of Achilles, the parting of Hector and Andromache, the description of the shield, the 22d book, the games, the ransom of Hector, or whatever attracts them most. And if modernistic or pseudo-scientific critics seek to mar our enjoyment by laying it down that the Homeric simile, the standing Homeric epithets, the repetition of certain formulas or motives are in themselves notes of a childish, a primitive, an inferior art, we have only to ask ourselves how do they know it? Is it true? Or may not these traits of Homeric style together with the roll of the Homeric hexameter be rather, as the overwhelming majority of the best informed modern critics from Sainte-Beuve to Quiller-Couch believe, the effectively and consciously employed conventions of the noblest art of poetry that has yet been given to man?

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ILINIZA, or ILINISA, Ecuador, a mountain, 20 miles south-southwest of Quito. It is capped by two peaks, the southernmost, as determined trigonometrically by Reiss and Stübel, being 17,406 feet high. Iliniza is presumably an extinct volcano, but there is no record of an eruption. The upper portion is covered with perpetual snow, and usually cloud-capped.

ILION, N. Y., village, Herkimer County, on the Mohawk River, the Erie Canal, and on the West Shore and the New York Central and Hudson River railroads, about three miles west of Herkimer and 12 miles southeast of Utica. Ilion is in the vicinity of the locations of some of the old «castles» of the Indian tribes who inhabited the Mohawk Valley. White people lived here in the early part of the 19th century, but no permanent settlement was made until 1828. It is situated in an agricultural county, but the village is noted for its manufacturing industries. The chief manufactures are typewriters, firearms, sewing-machines, filing cases, bicycles, knit goods, flour and some dairy products. Its export trade consists chiefly of the manufactured articles and farm products. It has a public library, municipal waterworks, electric-lighting plant and a number of fine public buildings. Pop. 8,900.

ILISSUS, il-is'us, Greece, a small river flowing through Athens, famous in the classical age, but now unimportant and often wholly dry.

ILITHYIA, il-ith-ī'ya, in Greek mythology, the goddess who assisted women in childbirth. In after times she was according to one myth identified with Artemis, and according to another, with Hera.

ILIUM, or **ILION,** a name of Troy (q.v.), in Asia Minor, which was founded by Ilus.

ILIYATS, il'ē-yats, a nomadic Mohammedan race of Persia, Khiva and Turkestan. The name Iliyat is the plural of *iel* (ell), a tribe equivalent to the Arabic *kabilah.* The Iliyats are mostly of Turkish, Arabic and Kurdish descent, and form an important portion of the population of Persia and adjacent countries; their actual numbers are not known, but it is said that the Iliyat tribes tributary to Khiva number 195,000. They live in tents and have no settled habitations. They are of the Sunni sect, but are not very strict. The women are said to be chaste, and many of the best families in Persia are of Iliyat origin.

ILKESTON, ĭl'kĕs-tŏn, England, a town of Derbyshire, 10 miles northwest of Derby. It first comes into history in 1251 when it was given the right to hold a fair, but it was not incorporated as a town until 1887. The gas works, water supply system, public market and cemetery are the property of the town. Nearby are coal mines and iron foundries. The town manufactures hosiery, lace and stoneware. Pop. 31,673.

ILLÆNUS, ĭl-lē'nŭs. See TRIBOLITES.

ILLAMPU, ē-lyäm'poo, or **SORATA,** a mountain of Bolivia, in the eastern Cordillera, overlooking Lake Titicaca, 50 miles north-northwest of La Paz. It is about 21,500 feet in height, and is believed to be the highest mountain of the Bolivian Andes, though this distinction is also claimed for Illimani (q.v.); it is probably exceeded by the Cerro de Huascan in Peru and by Aconcagua in Chile. Illampu is a magnificent mass, with three principal peaks, of which the most northern one which frequently is called Illampu by itself, has never been scaled. Seen from Titicaca it is the grandest mountain in America. Consult Conway, Sir W. M., 'The Bolivian Andes' (New York 1901); De Bonelli, L. H., 'Travels in Bolivia' (2 vols., London 1854); Forbes, D., 'Geology of Bolivia and South Peru' (In *Quarterly Journal of the Geological Society,* Vol. XVII, p. 7, London 1861).

ILLE-ET-VILAINE, ē-lā-vē-lān', a maritime department, formed out of the northeast portion of northwest France, old province of Brittany; area, 2,699 square miles; pop. (1911) 608,098, mostly of Celtic race. It is watered chiefly by the Vilaine and its tributary, the Ille, which unite near Rennes, the capital of the department. Ille-et-Vilaine consists of a granite plateau traversed by ranges of low hills. It is agricultural, cultivation having been greatly improved during recent years. The cider of this district is the best in France; the butter of Rennes is celebrated; the horses of the department are noted for their endurance and are in great request for the army; and bee-keeping is prosecuted. Iron is mined; slates are quarried; and salt is extracted. Saint Malo is the principal seaport.

ILLEGAL PRACTICES. See CORRUPT PRACTICES ACTS.

ILLEGALITY, the condition which arises when an act is performed in violation of the law. Its principal effect is to deprive the act of a legal status and if a contract, to render it unenforceable. A state of illegality results from positive statute expressly forbidding the act, such as gambling, or from general considerations of public policy. The law generally refuses to undo an illegal act, but innocent third parties may secure relief.

ILLEGITIMACY, the legal status of children born out of wedlock, is a subject discussed under three points of view, moral, legal and economic. As to what constitutes illegitimacy is variously defined in different countries where great variety exists both in theory and practice. As to the legal status of illegitimate children from the moral point of view, see BASTARD.

Only in a few European countries are statistics available to show the extent of illegitimacy, and there are no statistics in Canada. In the United States there seems no efficient national system of registration of marriages and births. Some of the individual States record the illegitimate births, but the figures are misleading, because incomplete. Thus, the State of Indiana, a few years ago, returned 38,370 legitimate and 560 illegitimate births — the illegitimate being only about 1.46 of the whole.

In the following table is shown the comparative prevalence of illegitimacy in the principal European cities:

ILLEGITIMATE BIRTHS TO EVERY 1,000 BORN.

Vienna	449	Dresden	208	Hamburg	138
Prague	439	Milan	204	Frankfort	132
Munich	439	Rome	194	Turin	132
Stockholm	396	Venice	189	Antwerp	129
Moscow	300	Breslau	186	Cologne	124
Budapest	299	Bucharest	175	Palermo	101
Copenhagen	279	Liège	174	The Hague	99
Paris	268	Christiania	162	Naples	86
Petrograd	236	Berlin	154	Rotterdam	70
Trieste	211	Ghent	144	London	64
Leipzig	211				

None of the above figures are presented as absolutely accurate. They can only be approximate in the best case, for in every country there must always be a large number of bastards who either are not registered at all, or who are registered as legitimate. But as far as they go the figures are instructive. They do not, however, enable one to form any conclusion as to the causes of illegitimacy in respect either of religion, of education, of industrial occupation or of distribution of population. Neither can any theory be well evolved from a racial basis.

From the only available statistics the following table has been prepared showing the average rate of illegitimacy in various countries:

	Per cent of illegitimates to total births		Per cent of illegitimates to total births
England and Wales	4.60	Portugal	14.00
Scotland	6.80	Rumania	5.00
Ireland	2.60	Russia	3.00
Austria (average)	14.10	Spain	5.40
Lower Austria	26.00	Sweden	14.88
Upper Austria	20.00	Norway	7.90
Dalmatia	3.50	Switzerland	4.80
Hungary	8.00	Brazil	25.00
Belgium	9.30	Canada	....
Denmark	10.00	Costa Rica	24.00
France	8.20	Guatemala — Whites	50.00
Germany (average)	9.47	Indians	25.00
Upper Bavaria	15.67	New South Wales	4.65
Prussia	8.24	Victoria	4.78
Alsace-Lorraine	8.10	Queensland	3.97
Greece	1.60	West Australia	3.95
Holland	3.22	Tasmania	3.40
Italy	7.45	New Zealand	3.12

In Scotland, where education is general, and thrift national, the rate of illegitimacy is notoriously high. And, as regards morals, it should be remembered that a high percentage of illegitimacy may mean that there is little or no prostitution. In Europe, generally, although not universally, there seems a tendency to decrease in the rate of illegitimacy; but how far that appearance may be due to moral causes it is impossible to say.

ILLICHPUR. See ELLICHPUR.

ILLIMANI, ĕl-yē-mä'nē, Bolivia, a volcanic mountain mass of the East Andean Cordillera, about 20 miles south of La Paz. It is a serrated ridge with four principal peaks, the loftiest of which, Condor Blanco, is 21,149 feet above sea-level. Illimani signifies «snow-mountain»; the line of perpetual snow commences at 15,000 feet, and there are glaciers on the north side at an elevation of 16,350 feet. At an altitude of 15,950 feet there is a considerable lake also bearing the name of Illimani. Among the first Europeans to make the ascent of the highest peaks are Wiener, Grumbhow and Ocampo in 1877 and Sir Martin Conway in 1898.

ILLINGTON, Margaret, American actress: b. Bloomington, Ill., 23 July 1881. She was educated at Illinois Wesleyan University and studied at the Chicago Musical College. She made her début in ‹The Pride of Jennico,› at the Criterion Theatre, New York, in 1900, played in Daniel Frohman's Stock Company at the Lyceum Theatre, New York, in 1902–03 and in the latter year created the leading rôle in ‹The Japanese Nightingale.› Subsequently she played the leading rôles in ‹The Two Orphans› (1904); ‹Mrs. Leffingwell's Boots› (1905); ‹The Lion and the Mouse› (1906); ‹His House in Order› (1906); ‹The Thief› (1907). She starred in ‹Kindling› (1911–12); ‹Within the Law› (1913–14); ‹The Lie› (1915–16); ‹Our Little Wife› (1916–17) and was a co-star with John Drew in ‹The Gay Lord Quex› (1917–18). In 1903 she married Daniel Frohman, but later separated from him and in 1909 was married to Edward J. Bowes of San Francisco.

ILLINGWORTH, John Richardson, English clergyman and author: b. London, 26 June 1848; d. Longworth, 22 Aug. 1915. He was graduated from Christ Church College, Oxford, in 1871. From 1872–83 he was tutor of Keble College and Fellow of Jesus College, Oxford. After 1883 he was rector of Longworth in Berkshire. From 1905 he was honorary canon of Christ Church, Oxford. He was select preacher at Oxford University in 1882, and filled the same office at Cambridge University in 1884 and 1895. In 1894 he delivered the Bampton lectures. He was the author of several volumes, ‹Sermons preached in a College Chapel› (1888); ‹University and Cathedral Sermons› (1893); ‹Personality, Human and Divine› (Bampton Lectures, 1894); ‹Divine Immanence› (1898); ‹Reason and Revelation› (1902); Christian Character› (1904); ‹The Doctrine of the Trinity› (1907); ‹Divine Transcendance› (1911); ‹Gospel Miracles› (1915). Consult ‹Life and Work of John Richardson Illingworth› (ed. by his wife, 1917).

ILLINOIS, ĭl'lĭ-noi' or -noiz, the eighth State admitted into the Union, and since 1890 the third in population, is one of the North Central States of the United States. It is widely known as the «Prairie State.» It lies between 87° and 35' and 91° and 40' W. longitude, and between 36° and 59' and 42° and 30' N. latitude. By the enabling Act of Congress, by virtue of which the State was organized, its boundaries were fixed as follows: «Beginning at the mouth of the Wabash River, thence up the same, and with the line of Indiana, to the northwest corner of said State; thence east with the line of the same State to the middle of Lake Michigan; thence north along the middle of said lake, to north latitude 42 degrees 30 minutes; thence west to the middle of the Mississippi River; and thence down along the middle of that river to its confluence with the Ohio River; and thence up the latter river along its northwestern shore, to the beginning.»

Topography, etc.— Illinois is practically surrounded by water. It is bounded on the northeast by Lake Michigan, on the north by Wisconsin, on the east by Indiana, on the south by Kentucky and on the west by Iowa and Missouri. It is separated from the two last named States by the Mississippi River, from Indiana by the Wabash and Ohio, and from Kentucky by the Ohio. Illinois has a gross area of 56,665 square miles, but 622 square miles represent water surface. Its extreme length is 385 miles and its extreme breadth 218 miles. It ranks twenty-third in size among the States of the Union. With the exception of Georgia, its area is greater than that of any one of the original States of the Union. It comprises a territory larger than that of England, or of Belgium, Switzerland and Holland combined. The largest county, McLean, has an area of 1,166 square miles, and the smallest, Putnam, an area of 176 square miles. With two exceptions — Louisiana and Delaware — Illinois is the most level of the States. Its greatest elevation is 1,150 feet above the sea, and its mean elevation is 550 feet. The larger part of its surface consists of level or slightly undulating prairies, but a portion of the extreme northwestern part is hilly, and there are occasional bluffs upon the Illinois and Mississippi rivers. In the extreme south also there is a range of hills rising to a height of about 1,000 feet.

Soil.— The soil consists of a rich black loam, or mold, underlaid by drift deposits, in many places of great depth, and varying from 10 to 200 feet. There are three sources of the soil in this State. The residuary soil, resulting from the decay of the original rock layers, is the first. Before the visit of the first ice sheet the entire State was probably overlaid with thick layers of residuary soil. A second kind of soil came from the first ice sheet, which brought into the State great quantities of waste material from the regions around and beyond the lakes. This was left scattered over the State, but it soon weathered and with the addition of humus made a black and rich prairie soil. After the disappearance of the first ice sheet and the making of the waste material into soil, there was a thick deposit of loess, which covered not only the glacial soil but also the residuary soil. After thousands of years there was a second ice invasion which reached as far south and west as the line traced west and north from Paris. A second glacial layer of waste several feet thick was thus left upon the loess beds. Illinois consequently has soil whose source is the residuary rocks (the area being very limited), soil from the loess deposits and that from the last ice sheet in the northeastern counties. The soil of the river valleys is alluvial and is especially fertile. The northern part of the State is especially well suited to the cultivation of hay, the north and central parts to Indian corn, the east to oats and the southwest to wheat.

Rivers, etc.— The water courses flow generally from the north and northeast to the south and southwest. The principal river of the State, the Illinois, is formed by the junction in Grundy County, 40 miles southwest of Chicago, of the Kankakee and Des Plaines. The last-named river takes its rise in Wisconsin and flows in a southerly direction, while the headwaters of the Kankakee are in northern Indiana. The Illinois is navigable for 245 miles and is connected by the Illinois and Michigan Canal with Lake Michigan. Other rivers in the State are the Sangamon, which flows in a westerly direction into the Illinois; the Kaskaskia, which flows in a southwesterly direction and empties into the Mississippi near the ancient village of Kaskaskia, the first capital of the State; Rock River, which flows in a southwesterly direction from Wisconsin and empties into the Mississippi not far from the city of Rock Island; the Little Wabash and the Embarras, which flow into the Wabash in the southeastern part of the State; and the Vermilion and the Fox, which are tributaries of the Illinois.

Climate.— Illinois lies between the isotherm of 55 on the south and 47 on the north. It is notable for extremes of temperature. Warm winds sweeping up the Mississippi Valley cause extreme heat; the Arctic winds from the north, unblocked by mountains, cause the extremes of cold. The range of extremes is greater in the north than in the south. Thus at Winnebago extremes have ranged from 26° F. to 110° F., and at Cairo from 16° F. to 106° F. The mean temperature for Springfield, near the central part of the State, is 52° F. The variation is about 2° F. for each degree of latitude. The State is well watered. The number of inches of rainfall is about 40 for the south end of the State, but it decreases to about 34 in the north. The mean annual snowfall increases from about 12 inches in the south to about 40 in the north. The source of the rainfall is chiefly the revolving storms from the northwest. At Cairo in the south, except during February, the prevailing winds are southerly, and as far north as Springfield they are southerly from April to January. Throughout the northern half of the State, except along the shore of Lake Michigan, where they vary from northeast to southwest, the winds are mostly from the west or northwest from October to March, and very variable for the rest of the year.

Population.— In 1810, one year after its organization as a Territory, the population of Illinois was 12,282; in 1820, two years after its admission as a State, its population was 55,211, and in rank it was the 24th State in the Union; in 1830, its population was 157,445 and its rank the 20th; in 1840, its population was 476,183 and its rank the 14th; in 1850, its population was 851,470 and its rank the 11th; in 1860, its population was 1,711,951, and its rank the 4th; in 1870, its population was 2,539,891 and its rank the same as in 1860; in 1880, its population was 3,077,871 and its rank still 4th; in 1890 its population was 3,826,351 and its rank the 3d; in 1900, its population had increased to 4,821,550 while its rank remained the same; in 1910, its population was 5,638,591 and its rank was still third. An analysis of the population as shown by the census of 1910 reveals the following interesting facts; 2,600,555, or 46.1 per cent, were native whites of native parentage; 1,723,847, or 30.6 per cent, were native whites of foreign or mixed parentage; 1,202,560, or 21.3 per cent, were foreign born whites; and 109,049, or 1.9 per cent, were negroes. Of the total native population, 76.8 per cent were born in Illinois, and 23.2 per cent outside the State. Of the total white stock of foreign origin, Germany contributed 34.7 per cent; the Scandinavian countries, 11.3; Ireland, 11.3; Austria, 9.6; Russia, 7.8; England, 5.8; Italy, 4; Canada, 3.7; Scotland, 1.8; Hungary, 1.8; and Holland, 1.1. Of the foreign born white population, Germans composed 26.5 per cent; Austrians, 13.6; Russians, 12.4; Swedes, 9.6; Irish, 7.8; Italians, 6; English, 5; Canadians, 3.7; Hungarians, 3.3; Norwegians, 2.7; all other countries, 9.2. Of the negro population, 66.8 per cent were born outside of the State. In most of the 102 counties the proportion of foreign born whites is small, being less than 5 per cent in 40 counties, and over 25 per cent in only six. Over two-thirds of the foreign born whites live in Cook County. Their percentage is 28.7 in the urban population and 9.5 in the rural; the percentage for the negroes is 2.5 in the urban and 1.1 in the rural districts. The male population predominates. In 1910 there were 2,911,674 males to 2,726,917 females or 106.8 males to 100 females; in 1900, the ratio was 105.3 to 100. Among native whites, in 1910, the ratio was only 101.5 to 100, but among foreign born whites it was 127.3 to 100. In the urban population there were 104.9 males to 100 females, and in the rural 109.9. These people occupied 1,006,848 dwellings and the total number of families was 1,264,717 or 125.6 families to 100 dwellings. The average number of persons per dwelling was 5.6, and the average number per family was 4.5. Cook county claimed 2,405,233 persons, Saint Clair County ranked next with 119,870, and Peoria County was third with 100,255. Taking the State as a whole, it had 100.6 people to the square mile in 1910, as compared with 86.1 in 1900, and 68.3 in 1890. The population according to census estimates increased from 5,638,591 in 1910 to 6,152,257 in 1916, and its density, consequently, from 100.6 to 109.8

Cities.— In 1910, 61.7 per cent of the entire population resided in incorporated places having 2,500 inhabitants or over; in 1900, the per cent was 54.3. In the same years the figures for the United States as a whole stood 46.3 and 40.5; for the New England States, 83.3 and 79.9; for Rhode Island, 96.7 and 95.1; for Massachusetts, 92.8 and 91.5. According to the last census there were 32 incorporated places in the State which had a population of over

ILLINOIS.

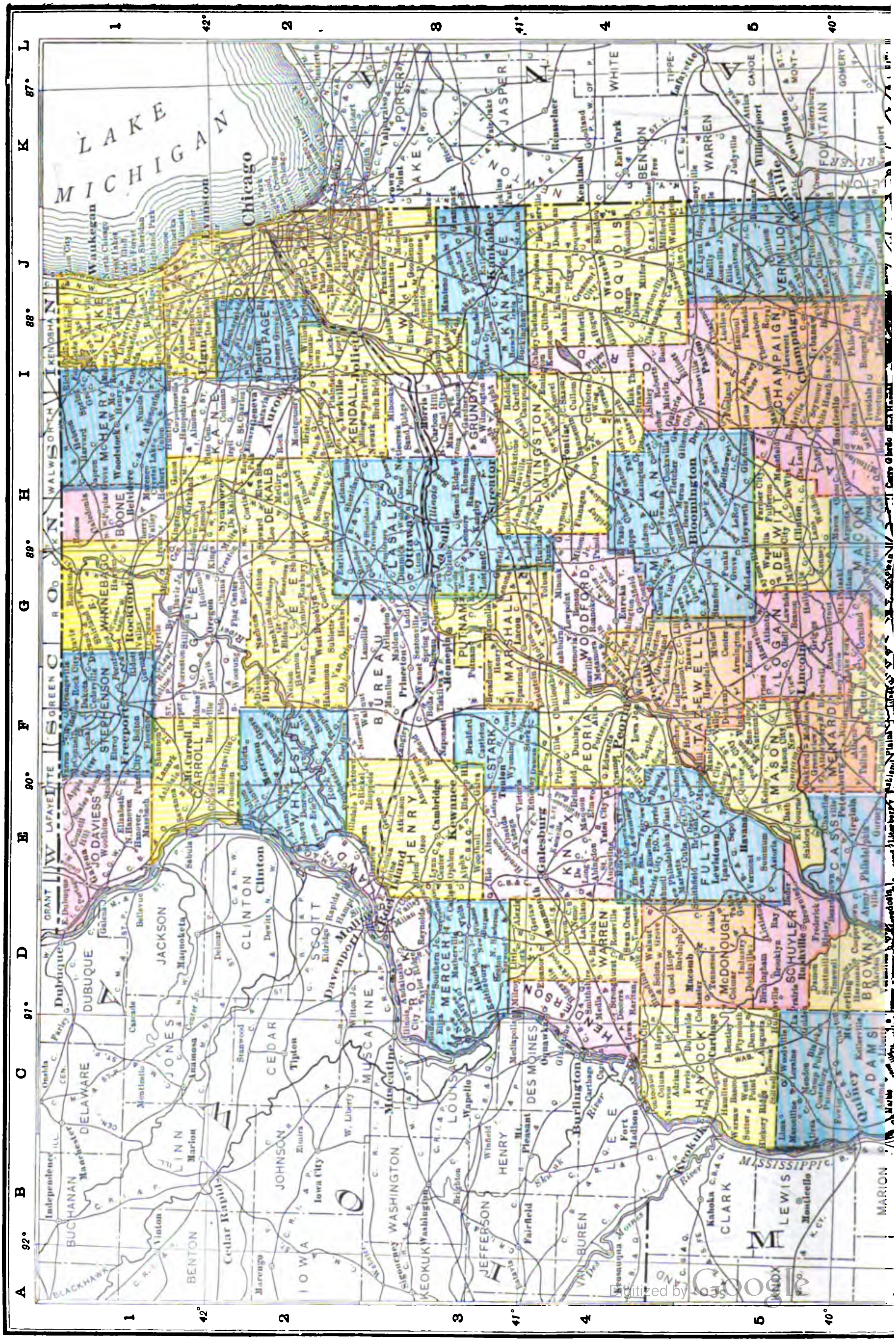
Estimated population, 6,152,257

COUNTIES

Pop.		
64,588	Adams	C 6
22,741	Alexander	G 11
17,075	Bond	G 8
15,481	Boone	H 1
10,397	Brown	D 6
43,975	Bureau	F 3
8,610	Calhoun	D 7
18,035	Carroll	F 1
17,372	Cass	E 6
51,829	Champaign	I 5
34,594	Christian	G 7
23,517	Clark	J 7
18,661	Clay	H 8
22,832	Clinton	G 8
34,517	Coles	I 6
2,405,233	Cook	J 2
26,281	Crawford	J 8
14,281	Cumberland	I 7
33,457	Dekalb	H 2
18,906	Dewitt	H 5
19,591	Douglas	I 6
33,432	Dupage	I 2
27,336	Edgar	J 6
10,049	Edwards	I 9
20,055	Effingham	H 7
28,075	Fayette	G 7
17,096	Ford	I 4
25,943	Franklin	H 9
49,549	Fulton	E 5
14,628	Gallatin	I 10
22,363	Greene	E 7
24,162	Grundy	I 3
18,227	Hamilton	H 9
30,638	Hancock	C 5
7,015	Hardin	I 11
9,724	Henderson	D 4
41,736	Henry	E 3
35,543	Iroquois	J 4
35,143	Jackson	G 10
18,157	Jasper	I 7
29,111	Jefferson	H 9
13,954	Jersey	E 7
22,657	Jo Daviess	E 1
14,331	Johnson	H 11
91,862	Kane	I 2
40,752	Kankakee	J 3
10,777	Kendall	I 2
46,159	Knox	E 4
55,058	Lake	I 1
90,132	LaSalle	H 3
22,661	Lawrence	J 8
27,750	Lee	G 2
40,465	Livingston	H 4
30,216	Logan	G 5
26,887	McDonough	D 5
32,509	McHenry	I 1
68,008	McLean	H 4
54,186	Macon	G 6
50,685	Macoupin	F 7
89,847	Madison	F 8
35,094	Marion	H 8
15,679	Marshall	G 3
17,377	Mason	F 5
14,200	Massac	H 11
12,796	Menard	F 5
19,723	Mercer	D 3
13,508	Monroe	E 9
35,311	Montgomery	G 7
34,420	Morgan	E 6
14,630	Moultrie	H 6
27,864	Ogle	G 1
100,255	Peoria	F 4
22,088	Perry	G 9
16,376	Piatt	H 5
28,622	Pike	D 6
11,215	Pope	H 11
5,650	Pulaski	G 11
7,561	Putnam	G 3
29,120	Randolph	F 9
15,970	Richland	I 8
70,404	Rock Island	D 3
119,870	St. Clair	F 9
30,204	Saline	H 10
91,024	Sangamon	F 7
14,852	Schuyler	D 5
10,067	Scott	D 6
31,693	Shelby	H 7
10,098	Stark	F 3
36,821	Stephenson	F 1
34,027	Tazewell	F 5
21,856	Union	G 11
77,996	Vermilion	J 5
14,913	Wabash	J 9
23,313	Warren	D 4
18,759	Washington	G 9
25,697	Wayne	I 9
23,052	White	I 9
34,507	Whiteside	F 2
84,371	Will	J 3
45,098	Williamson	H 10
63,153	Winnebago	G 1
20,506	Woodford	G 4

Incorporated Cities, Towns, and Villages

Pop.		
2,464	Abingdon	E 4
269	Addieville	G 9
579	Addison	J 2
155	Adeline	F 1
200	Akin	H 10
618	Albany	E 2
1,281	Albion	I 9
2,144	Aledo	D 3
829	Alexis	D 3
642	Algonquin	I 1
433	Alhambra	F 8
245	Allenville	H 7
379	Allerton	J 6
380	Alma	G 8
358	Alpha	E 3
1,328	Altamont	H 7
22,874	Alton	E 8
828	Altona	E 3
551	Alto Pass	G 10
319	Alvin	J 5
1,749	Amboy	G 2
299	Andalusia	D 3
222	Andover, Henry	E 3
2,809	Anna	G 11
398	Annawan	F 3
682	Antioch	J 1
581	Apple River	F 1
2,100	Arcola	I 6
518	Arenzville	E 6
519	Argenta	E 6
370	Arlington	G 3
1,943	Arlington Heights	I 1
327	Armington	F 5
366	Arrowsmith	H 5
1,080	Arthur	I 6
416	Ashkum	I 4
1,096	Ashland	F 6
913	Ashley	G 9
511	Ashmore	I 6
779	Ashton	G 2
1,918	Assumption	G 6
1,357	Astoria	E 5
1,340	Athens	F 6
803	Atkinson	E 3
1,367	Atlanta	G 5
639	Atwood	F 7
1,814	Auburn	F 6
1,146	Augusta	C 5
34,204	Aurora	I 2
780	Ava	F 14
2,668	Averyville, Peoria	F 4
397	Aviston	F 8
865	Avon, Fulton	E 5
144	Baalton, Stephenson	F 1
358	Baldwin	F 9
252	Barclay	F 6
335	Bardolph	D 5
1,444	Barrington	I 1
1,047	Barry	C 6
344	Bartelso	F 8
408	Bartlett, Cook	J 2
1,536	Bartonville, Peoria	F 4
255	Basco	C 5
4,436	Batavia	I 2
300	Batchtown	D 7
475	Bath	E 5
385	Baylis	D 6
6,107	Beardstown	E 5
401	Beaverville	J 4
764	Beckemeyer	G 8
543	Beecher	J 3
355	Beecher City	H 7
433	Belgium, Vermilion	J 5
404	Belknap	H 11
87	Belle Prairie	H 9
312	Bellerive	H 9
21,149	Belleville	F 9
394	Bellflower	H 5
550	Bellmont	J 9
943	Bellwood, Cook	J 2
7,253	Belvidere	H 1
1,530	Bement	H 6
205	Benbow City, Madison	F 8
1,912	Benld	F 7
443	Bensenville, Dupage	I 2
362	Benson	G 4
89	Bentley	C 5
2,675	Benton	H 9
251	Berlin, Sangamon	F 6
5,841	Berwyn, Cook	I 2
447	Bethalto	E 8
859	Bethany	H 8
400	Biggsville	D 4
191	Bingham, Fayette	G 8
382	Birds	J 8
289	Bishop Hill	E 3
987	Blandinsville	D 4
462	Bloomingdale, Dupage	I 2
27,258	Bloomington	H 5
9,254	Blue Island	J 8
900	Blue Mound	G 2
766	Bluffs	D 6
485	Bolton	F 6
517	Bone Gap	J 1
162	Bonfield	I 9
611	Bourbonnais	J 3
606	Bowen	C 3
971	Braceville	I 3
770	Bradford	F 3
1,942	Bradley	J 3
1,958	Braidwood	I 3
2,128	Breese	F 8
2,703	Bridgeport	J 8
595	Brighton	F 7
576	Brimfield	F 4
394	Bristol	I 2
489	Broadlands	I 9
246	Broadwell	G 5
558	Brocton	J 6
2,186	Brookfield, Cook	J 2
1,569	Brooklyn, St. Clair	F 9
1,443	Brookport	H 11
398	Brookville	F 1
470	Broughton	I 10
551	Browning	E 5
419	Browns	I 9
415	Brownstown	G 7
283	Brussels	D 8
237	Bryant	E 5
272	Buckingham	I 3
495	Buckley	I 4
887	Buda	F 3
475	Buffalo	G 6
1,046	Bunker Hill	E 7
534	Bureau	F 3
187	Burksville	E 9
282	Burlington, Kane	I 2
328	Burnham, Cook	J 2
565	Bush	G 10
2,619	Bushnell	E 4
233	Butler	F 7
932	Byron	G 1
321	Cabery	I 4
360	Cable	E 3
15,794	Cairo	G 11
323	Camargo	I 6
1,272	Cambridge	E 3
414	Campbell Hill	F 10
1,148	Camp Point	C 5
241	Campus	I 3
13,262	Canton	E 5
318	Cantrall	F 7
366	Carbon Cliff, R. I.	D 3
562	Capron	H 1
5,411	Carbondale	G 10
820	Carbon Hill	I 3
1,031	Cardiff	I 3
3,616	Carlinville	E 7
1,982	Carlyle	G 8
2,833	Carmi	I 9
1,128	Carpentersville	I 1
1,558	Carrier Mills	H 10
2,323	Carrollton	E 7
2,971	Carterville	G 10
2,373	Carthage	C 5
679	Cary Station	I 1
2,157	Casey	J 7
613	Caseyville	F 8
932	Catlin	J 5
306	Cave in Rock	I 11
545	Cedar Pt., La Salle	H 3
311	Cedarville	F 1
287	Central City, Grundy	I 3
1,179	Central City	G 8
11,538	Centralia	G 9
876	Cerro Gordo	H 6
527	Chadwick	E 2
14,508	Champaign	I 5
884	Chandlerville	E 5
208	Channahon, Will	J 3
552	Chapin	E 6
5,884	Charleston	I 6
666	Chatham	F 6
1,112	Chatsworth	I 4
590	Chebanse	I 4
1,314	Chenoa	H 4
1,048	Cherry	G 3
433	Cherry Valley	H 1
2,747	Chester	F 10
364	Chesterfield	E 7
2,497,722	Chicago	K 2
21,693	Chicago Heights	J 2
1,851	Chillicothe	F 4
1,193	Chrisman	J 6
1,825	Christopher	G 10
19,974	Cicero, Cook	I 2
379	Cisco	H 6
373	Cisne	I 9
632	Cissna Park	J 4
186	Claremont	J 8
230	Clarke City	I 3
837	Clay City	I 8
940	Clayton	C 6
634	Clifton	I 4
5,165	Clinton	H 5
2,667	Coal City	I 3
190	Coal Valley	D 3
262	Coatsburg	C 5
988	Cobden	G 11
980	Coffeen	G 7
1,445	Colchester	D 5
965	Colfax	H 4
7,478	Collinsville	F 8
217	Colona	E 3
2,076	Columbia	E 9
134	Columbus, Adams	C 6
387	Compton	G 2
332	Cooksville	H 4
324	Cordova	E 2
536	Cornell	H 4
207	Cortland	H 2
949	Coulterville	F 9
711	Cowden	G 7
446	Crainville	G 10
936	Creal Springs	H 10
341	Crescent City	J 4
323	Creston	G 2
840	Crete	J 3
574	Crossville	I 9
1,005	Crotty, La Salle	H 3
1,242	Crystal Lake	H 1
2,019	Cuba	E 5
579	Cullom	I 4
324	Cutler	F 9
311	Cypress	G 11
654	Dahlgren	H 9
227	Dakota	F 1
1,288	Dallas City	C 4
400	Dalton City	H 6
949	Dalzell, Bureau	F 3
254	Dana	G 4
410	Danforth	I 4
593	Danvers	G 5
32,261	Danville	J 5
352	Davis	G 1
620	Dawson	G 6
39,631	Decatur	H 6
332	Deer Creek	G 4
476	Deerfield	J 1
9,482	Dekalb	H 2
503	DeLand	H 5
1,175	Delavan	F 5
1,339	Depue	G 3
644	De Soto	G 10
2,348	Des Plaines	J 1
127	Detroit	D 6
220	Dewitt	G 5
255	Diamond	I 3
493	Dieterich	I 7
1,319	Divernon	F 6
7,216	Dixon	F 2
1,869	Dolton	J 2
702	Dongola	G 11
405	Donnellson	G 7
346	Donovan	J 4
102	Dorchester	E 7
1 184	Dorrisville, Saline	H 10
181	Dover Bureau	F 3
2,601	Downers Grove	I 2
331	Dubois	G 9
2,785	Dundee	I 2
433	Dupo, St. Clair	F 9
5,454	Duquoin	G 10
527	Durand	G 1
2,156	Dwight	I 3
1,059	Earlville	G 3
581	East Alton	E 8
446	East Brooklyn, Grundy	I 3
212	East Carondelet	E 9
1,253	East Dubuque	E 1
753	East Galesburg, Knox	E 4
2,665	East Moline	E 3
407	Easton	F 5
7,493	East Peoria	F 4
74,708	East St. Louis	E 8
367	East Wenona, La Salle	H 3
400	East Wood River, Madison	F 8
145	Eddyville	H 1
419	Edgewood	H 8
918	Edinburg	G 6
543	Edison Park, Cook	J 2
5,014	Edwardsville	F 8
3,898	Effingham	H 7
677	Eileen, Grundy	I 3
613	Elburn	I 2
195	El Dara	D 6
3,366	Eldorado	I 10
241	Eldred	D 7
28,203	Elgin	I 1
703	Elizabeth	E 1
633	Elizabethtown	I 11
418	Elkhart	G 5
732	Elkville	G 10
371	Elliott	I 4
252	Ellis Grove	F 10
218	Ellisville	E 4
2,360	Elmhurst	I 2
1,390	Elmwood	E 4
1,470	El Paso	H 4
267	Elsah	E 8
250	Elvaston	C 5
211	Elwood	I 3
411	Emden	G 5
190	Emington	I 4
927	Enfield	I 9
1,180	Equality	H 10
804	Erie	E 2
342	Essex	I 3
1,525	Eureka	G 4
28,591	Evanston	J 1
562	Evansville	F 9
424	Evergreen Park, Cook	J 2
317	Ewing	H 9
201	Exeter	D 6
2,505	Fairbury	H 4
2,479	Fairfield	H 9
847	Fairmount	J 6
482	Fairview	E 4
215	Fancher, Shelby	H 7
774	Farina	H 8
1,603	Farmer City	H 5
533	Farmersville	G 7
2,421	Farmington	E 4
228	Fayettev'e, St. Clair	F 9
299	Ferris	C 5
211	Fidelity	E 7
227	Fieldon	E 7
499	Fillmore	G 7
827	Findlay	H 6
850	Fisher	I 5
386	Fithian	J 5
590	Flanagan	H 4
840	Flat Rock	J 8
2,704	Flora	I 8
385	Fordville, Williamson	G 10
392	Fordyce, Jackson	G 10
306	Forest City	F 5
6,594	Forest Park, Cook	I 2
967	Forrest	I 4
870	Forreston	F 1
90	Fosterburg, Madison	F 8
400	Fox Lake	I 1
273	Frankfort	J 3
696	Franklin	E 6
572	Franklin Grove	G 2
683	Franklin Park	J 2
1,397	Freeburg	F 9
19,568	Freeport	F 1
2,174	Fulton	E 2
745	Galatia	H 10
4,835	Galena	E 1
24,276	Galesburg	E 4
2,498	Galva	E 3
946	Gardner	I 3
290	Garrett	I 6
685	Gaskins City, Saline	H 10
322	Gays	H 7
3,199	Geneseo	E 3
2,451	Geneva	I 2
1,257	Genoa	H 1
2,307	Georgetown	J 6
711	Germantown	F 9
2,086	Gibson City	H 5
268	Gilberts	I 2
2,241	Gillespie	F 7
1,305	Gilman	I 4
1,891	Girard	F 7
385	Gladstone	C 4
625	Glasford	F 4
215	Glasgow	D 6
1,220	Glen Carbon, Madison	F 8
1,899	Glencoe	J 1
1,763	Glenellyn, Dupage	I 2
652	Glen View, Cook	J 2
581	Glenwood, Cook	J 2
68	Godfrey	E 8
194	Godley, Grundy	I 3
1,088	Golconda	H 11
579	Golden	D 5
311	Golden Gate	I 9
361	Good Hope	D 4
554	Goreville	H 10
1,116	Grafton	E 8
403	Grand Ridge	H 3
873	Grand Tower	F 10
15,142	Granite City	E 8
692	Grant Park	J 3
1,391	Granville	G 3
603	Grayslake	J 1
1,940	Grayville	J 9
1,161	Greenfield	E 7
1,224	Greenup	I 7
921	Greenview	F 5
3,178	Greenville	F 8
750	Gridley	H 4
1,262	Griggsville	D 6
1,008	Gross Point, Cook	J 2
66	Hainesville, Lake	I 1
335	Hamburg	D 7
1,627	Hamilton	C 5
215	Hamletsburg	H 11
492	Hammond	H 6
697	Hampshire	I 1
348	Hampton	D 2
650	Hanover	E 1
654	Hardin	D 7
162	Harmon	F 2
5,309	Harrisburg	H 10
350	Hartsburg	G 5
3,008	Harvard	H 1
396	Harvel	F 7
7,227	Harvey	J 2
3,525	Havana	E 5
644	Hebron	I 1
187	Hecker	F 9
171	Henderson	E 3
451	Hennepin	G 3
364	Henning	J 5
1,687	Henry	G 3
618	Herrick	G 7
6,861	Herrin	G 10
461	Herscher	I 3
306	Hettick	E 7
681	Heyworth	H 5
190	Hidalgo	I 7
2,675	Highland	F 8
4,209	Highland Park	J 1
1,219	Highwood, Lake	J 1
351	Hillery, Vermilion	J 5
3,424	Hillsboro	G 7
328	Hillside, Cook	J 2
309	Hillview	D 7
661	Hinckley	H 2
498	Hindsboro	I 6
2,451	Hinsdale	I 2
480	Hodgkins, Cook	J 2
196	Hollowayville, Bureau	F 3
1,086	Homer	I 5
713	Homewood	J 2
4,698	Hoopeston	J 5
586	Hopedale	F 5
451	Hoyleton	G 9
375	Hudson	H 4
205	Huey	G 8
541	Hull	C 6
356	Humboldt	I 6
572	Hume	J 6
235	Hunt	I 7
773	Huntley	H 1
345	Hurst	G 10
722	Hutsonville	J 7
849	Illiopolis	G 6
484	Ina, Jefferson	G 9
365	Indianola	J 6
580	Industry	D 5
652	Ipava	E 5
286	Iroquois	J 4
678	Irving	G 7
223	Irvington	G 9
333	Itasca, Dupage	I 2
364	Iuka	H 8
436	Ivesdale	I 6
15,481	Jacksonville	E 6
237	Jeffersonville	H 9
4,113	Jerseyville	E 7
366	Jewett	I 7
225	Johnsonville	H 9
3,248	Johnston	H 10
38,010	Joliet	I 2
1,169	Jonesboro	G 11
734	Joppa	H 11
516	Joy, Mercer	D 3
300	Junction City	I 10
506	Kampsville	D 7
521	Kane	E 7
380	Kangley	H 3
14,230	Kankakee	J 3
945	Kansas	J 6
142	Kappa	H 4
142	Kaskaskia, Randolph	F 9
405	Keensburg	J 9
1,515	Keithsburg	D 3
269	Kempton	I 4
881	Kenilworth, Cook	J 2
570	Kenney	G 2
13,561	Kewanee	E 3
670	Keyesport	G 8
371	Kinderhook	C 6
424	Kilbourne	E 5
294	Kingston	H 1
492	Kingston Mines	F 4
997	Kinmundy	H 8
219	Kinsman	H 3
683	Kirkland	H 1
926	Kirkwood	D 4
1,818	Knoxville	E 4
1,495	Lacon	G 3
1,910	Ladd	G 3
287	La Fayette	E 3
5,282	La Grange	J 2
1,131	La Grange Park, Cook	J 2
1,349	La Harpe	C 4
726	Lake Bluff	J 1
3,349	Lake Forest	J 1
342	Lake Villa	I 1
304	Lake Zurich	I 1
555	Lamoille	F 3
1 175	Lanark	F 1
1,060	Lansing	J 2
187	La Prairie	D 5
155	La Rose	G 4
12,221	La Salle	H 3
438	Latham	G 6
3,235	Lawrenceville	J 8
469	Leaf River	G 1
1,907	Lebanon	F 8
599	Ledford	H 10
303	Lee	H 2
545	Leland	H 2
2,284	Lemont	I 2
1,168	Lena	F 1
463	Lenzburg	F 9
203	Leonore	H 3
145	L'Erable	J 4
391	Lerna	I 7
1,702	Le Roy	H 5
2,312	Lewistown	E 5
1,318	Lexington	H 4
1,724	Libertyville	I 1
797	Lima	C 2
11,838	Lincoln	F 5
197	Lisbon	I 3
5,971	Litchfield	F 7
358	Little York	D 3
1,092	Livingston	F 8
530	Loami	F 6
2,555	Lockport	I 2
603	Loda	I 5
883	Lombard	I 2
555	London Mills	E 4
239	Long Point	H 4
237	Longview	I 6
417	Loraine	C 5
458	Lostant	G 3
670	Louisville	I 8
1,011	Lovington	H 6
305	Ludlow	I 5
390	Lyndon	F 2
94	Lynnville	E 6
1,483	Lyons, Greene	E 7
1,031	McHenry	I 1
707	McLean	G 5
1,796	McLeansboro	I 9
285	Macedonia	H 10
725	Mackinaw	G 4
5,774	Macomb	D 5
683	Macon	G 6
5,046	Madison	E 8
284	Maeystown	E 9
368	Magnolia	G 3
565	Mahomet	I 5
400	Makanda	G 10
255	Malden	G 3
450	Malta	H 2
480	Manchester	E 6
443	Manhattan	J 3
218	Manlius	F 3
696	Manito	F 5
681	Mansfield	H 5
1,229	Manteno	J 3
389	Maple Park	H 2
472	Maquon	E 4
1,936	Marengo	H 1
329	Marietta	E 5
685	Marine	F 8
7,093	Marion	H 10
2,004	Marissa	F 9
1,023	Marks, Putnam	G 3
1,160	Maroa	H 6
494	Marquette, Bureau	F 3
3,291	Marseilles	H 3


LAKE MICHIGAN
Chicago
Joliet
Aurora
Elgin
Waukegan
Rockford
Freeport
Galena
Peoria
Galesburg
Bloomington
Champaign
Ottawa
Kankakee
Quincy
Rock Island
Moline
Davenport
Dubuque
Clinton
Muscatine
Burlington
Keokuk
Cedar Rapids
Iowa City
Lafayette
Danville
Lincoln
Pontiac
Macomb
MISSISSIPPI
COOK
LAKE
McHENRY
BOONE
WINNEBAGO
STEPHENSON
JO DAVIESS
CARROLL
OGLE
DE KALB
KANE
DU PAGE
WILL
KENDALL
GRUNDY
LA SALLE
LEE
WHITESIDE
BUREAU
PUTNAM
MARSHALL
STARK
HENRY
ROCK ISLAND
MERCER
KNOX
PEORIA
WOODFORD
LIVINGSTON
KANKAKEE
IROQUOIS
FORD
McLEAN
TAZEWELL
FULTON
McDONOUGH
WARREN
HENDERSON
HANCOCK
SCHUYLER
BROWN
ADAMS
CASS
MASON
MENARD
LOGAN
DE WITT
MACON
CHAMPAIGN
VERMILION
WISCONSIN
IOWA
INDIANA
DUBUQUE
DELAWARE
BUCHANAN
JACKSON
CLINTON
SCOTT
CEDAR
JONES
LINN
BENTON
IOWA
JOHNSON
MUSCATINE
LOUISA
WASHINGTON
KEOKUK
JEFFERSON
HENRY
DES MOINES
LEE
VAN BUREN
CLARK
LEWIS
MARION
LAKE
PORTER
JASPER
NEWTON
BENTON
WARREN
FOUNTAIN
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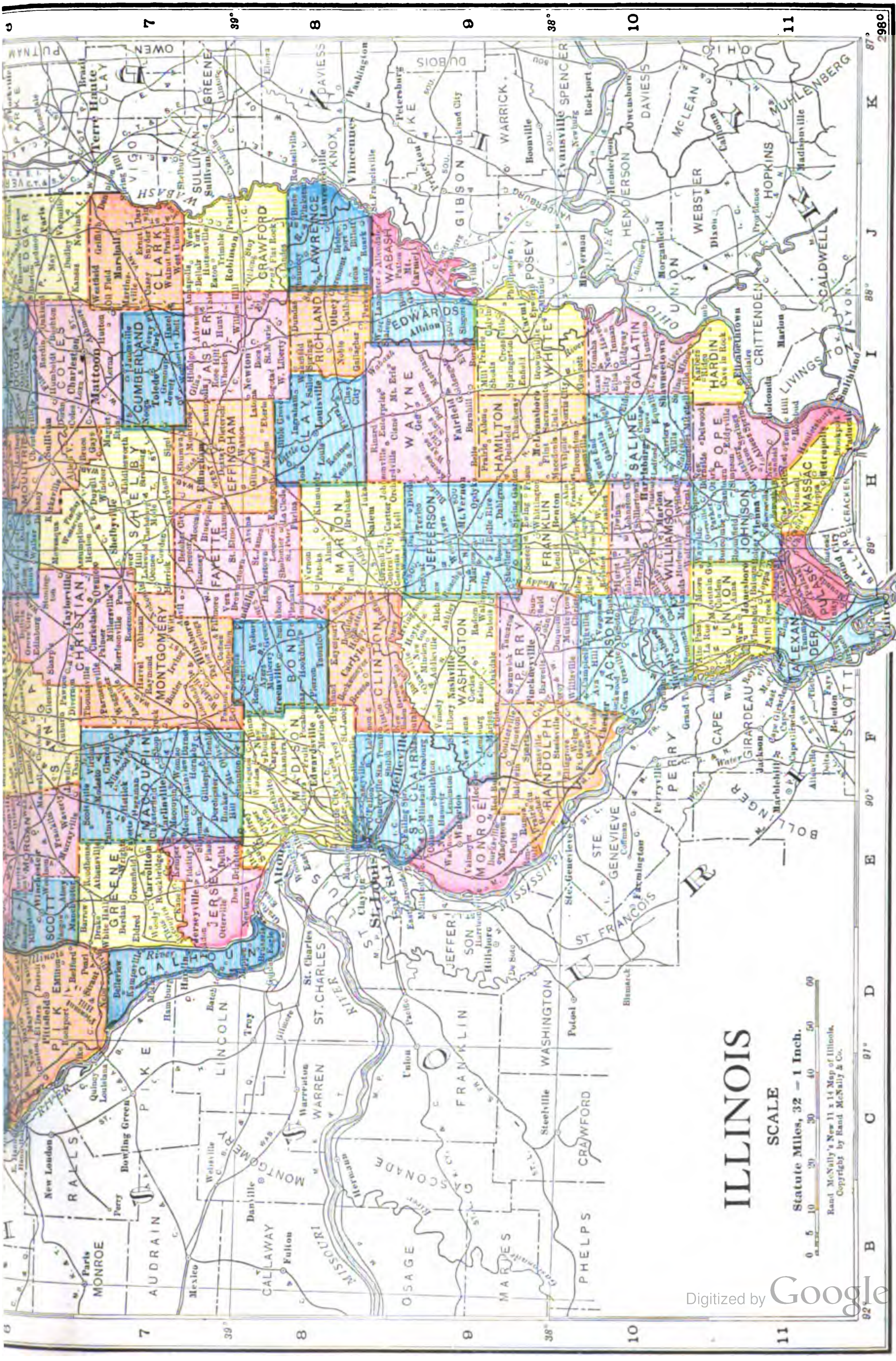
ILLINOIS
SCALE
Statute Miles, 32 = 1 Inch.
0 5 10 20 30 40 50 60
Rand McNally's New 11 x 14 Map of Illinois.
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EDGAR
COLES
CLARK
CUMBERLAND
JASPER
CRAWFORD
LAWRENCE
RICHLAND
WABASH
EDWARDS
WAYNE
CLAY
EFFINGHAM
SHELBY
FAYETTE
MARION
JEFFERSON
HAMILTON
WHITE
GALLATIN
SALINE
HARDIN
POPE
WILLIAMSON
FRANKLIN
JOHNSON
MASSAC
PULASKI
ALEXANDER
UNION
JACKSON
PERRY
RANDOLPH
WASHINGTON
CLINTON
BOND
MONTGOMERY
CHRISTIAN
MACOUPIN
MADISON
ST. CLAIR
MONROE
JERSEY
GREENE
CALHOUN
SCOTT
MORGAN
PIKE
SANGAMON
MOULTRIE
ST. LOUIS
St. Louis
E. St. Louis
Belleville
Alton
Cairo
Vincennes
Evansville
Terre Haute
Mattoon
Charleston
VIGO
CLAY
SULLIVAN
GREENE
KNOX
DAVIESS
PIKE
GIBSON
WARRICK
POSEY
VANDERBURG
SPENCER
HENDERSON
UNION
WEBSTER
HOPKINS
CRITTENDEN
CALDWELL
LIVINGSTON
LYON
MUHLENBERG
McLEAN
DAVIESS
MCCRACKEN
BALLARD
OHIO
INDIANA
KENTUCKY
MISSOURI
MONROE
RALLS
PIKE
AUDRAIN
CALLAWAY
MONTGOMERY
LINCOLN
WARREN
ST. CHARLES
OSAGE
GASCONADE
FRANKLIN
JEFFERSON
WASHINGTON
ST. FRANCOIS
STE. GENEVIEVE
PERRY
CAPE GIRARDEAU
BOLLINGER
SCOTT
CRAWFORD
PHELPS
MARIES
MISSISSIPPI
MISSISSIPPI RIVER
OHIO RIVER
WABASH
ILLINOIS RIVER
MISSOURI RIVER
39°
38°
87°
88°
89°
90°
91°
92°
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J
K

Pop.		
2,589	Marshall	J 7
1,500	Martinsville	J 7
312	Martinton	J 4
742	Marysville, Vermillion	J 5
729	Maryland, Madison	F 8
2,081	Mascoutah	F 9
345	Mason	H 8
1,842	Mason City	F 5
461	Matteson	J 2
12,582	Mattoon	I 6
512	Maunie	I 9
10,529	Maywood	J 2
471	Mazon	I 3
417	Mechanicsburg	G 6
226	Media	D 4
444	Medora	E 7
4,806	Melrose Park	J 2
509	Melvin	I 4
640	Mendon	C 5
3,806	Mendota	G 2
951	Meredosia	D 6
694	Metamora	G 4
449	Metcalf	J 6
4,655	Metropolis City	H 11
751	Middletown	F 5
727	Milan	D 3
1,316	Milford	J 4
221	Mill Creek	G 11
630	Milledgeville	F 2
417	Millersburg	D 3
223	Millington	I 3
700	Mill Shoals	I 9
1,140	Millstadt	E 9
330	Milton	D 6
349	Mineral	F 3
690	Minier	G 5
2,070	Minonk	G 4
361	Minooka	I 3
298	Modesto	F 7
359	Mokena, Will	J 3
27,451	Moline	D 2
2,201	Momence	J 3
411	Monee	J 3
10,177	Monmouth	D 4
371	Montgomery	I 2
1,981	Monticello	I 6
347	Montrose	I 7
3,694	Morgan Park, Cook	J 2
4,563	Morris	I 3
2,410	Morrison	F 2
1,126	Morrisonville	G 7
1,004	Morton	G 4
836	Morton Grove	J 1
2,837	Mound City	G 11
1,686	Mounds	G 11
194	Mound Station, Brown	D 6
463	Mt. Auburn	G 6
6,934	Mt. Carmel	J 6
1,759	Mt. Carroll	F 9
299	Mt. Erie	I 9
276	Mt. Greenwood, Cook	J 2
1,132	Mt. Morris	F 1
3,501	Mt. Olive	F 7
1,511	Mt. Pulaski	G 6
1,986	Mt. Sterling	D 6
9,760	Mt. Vernon	H 9
330	Mt. Zion	H 6
1,513	Moweaqua	H 6
716	Mulberry Grove	G 8
251	Muncie	J 5
7,485	Murphysboro	G 10
450	Murrayville	E 6
3,449	Naperville	I 2
457	Naples	D 6
2,135	Nashville	F 9
253	National City, St. Clair	F 9
1,020	Nauvoo	C 4
520	Nebo	D 7
1 074	Neoga	I 7
542	Neponset	F 3
406	Newark	H 2
1,131	New Athens	F 9
1,372	New Baden	F 9
690	New Berlin	F 6
718	New Boston	C 3
369	New Burnside	H 11
473	New Canton	C 6
499	New Douglas	F 8
490	New Grand Chain, Pulaski	G 11
514	New Haven	I 10
387	New Holland	F 5
1,264	Newman	J 6
243	New Memphis, Clinton	G 8
245	New Minden	G 9
260	New Salem	D 6
2,108	Newton	I 8
660	New Windsor	E 3
685	Niantic	G 6
569	Niles, Cook	J 2
568	Niles Center	J 1
401	Nilwood	F 7
618	Noble	I 8
1,872	Nokomis	G 7
251	Nora	F 1
4,024	Normal	H 4
560	Norris	E 4
1,055	Norris City	E 4
352	North Aurora, Kane	I 2
3,306	North Chicago	J 1
911	North Chillicothe, Peoria	F 4
689	North Crystal Lake, McHenry	I 1
317	Oakford	F 5
1,159	Oakland	I 6
287	Oaklawn, Cook	J 2
26,654	Oak Park	J 2
423	Oakwood	J 5
1,482	Oblong	J 8
293	Oconee	G I
1,035	Odell	I 3
1,400	Odin	G 8
2,018	O'Fallon	E 8
428	Ogden	J 5
527	Ohio	F 2
579	Okawville	B 9
314	Old Marissa, St. Clair	F 9
146	Old Ripley, Bond	G 8
288	Olmsted	G 1
5,011	Olney	I 8
856	Omaha	I 10
1,273	Onarga	J 4
589	Oneida	E 3
907	Oquawka	C 4
370	Orangeville	F 1
2,180	Oregon	G 2
655	Orion	E 3
369	Orland, Cook	J 2
600	Oswego	I 2
9,535	Ottawa	G 3
179	Otterville	E 7
365	Owaneco	G 7
1,144	Palatine	I 1
1,399	Palestine	J 7
404	Palmer	G 7
873	Palmyra	E 7
6,055	Pana	G 7
708	Panama	F 7
108	Panola	G 4
183	Papineau	J 4
7,664	Paris	J 6
283	Parkersburg	J 8
2,009	Park Ridge, Cook	J 2
676	Patoka	G 8
1,399	Pawnee	F 6
709	Pawpaw	G 2
2,912	Paxton	I 5
467	Payson	C 6
842	Pearl	D 7
485	Pearl City	F 1
1,022	Pecatonica	G 1
10,823	Pekin	F 4
71,458	Peoria	F 4
582	Peoria Heights, Peoria	F 4
1,207	Peotone	J 3
1,033	Percy	F 10
649	Perry	D 6
7,984	Peru	G 3
376	Pesotum	I 6
2,587	Petersburg	E 6
105	Phillipstown	J 9
562	Philo	I 6
679	Phoenix, Cook	J 2
2,722	Pinckneyville	G 9
135	Pingree Grove, Kane	I 2
663	Piper City	I 4
2,095	Pittsfield	D 6
227	Pittsburg	H 10
1,019	Plainfield	I 2
251	Plainville	C 6
1,627	Plano	H 2
576	Pleasant Hill	D 7
625	Pleasant Plains	F 6
829	Plymouth	D 5
749	Pocahontas	F 8
1,828	Polo	F 2
6,090	Pontiac	H 4
285	Pontoosuc	C 4
297	Poplar Grove	H 1
642	Port Byron	E 2
3,194	Portland, La Salle	H 3
343	Posen, Cook	J 2
719	Prairie City	E 4
511	Prairie du Rocher	E 9
4,131	Princeton	F 3
982	Princeville	F 4
1,083	Prophetstown	F 2
592	Pulaski	G 11
36,798	Quincy	C 6
238	Raleigh	I 10
769	Ramsey	G 7
858	Rankin	J 5
370	Ransom	H 3
1,384	Rantoul	I 5
143	Rapids City	E 2
881	Raymond	F 7
1,240	Red Bud	E 9
288	Reddick	I 3
240	Redmon	J 6
658	Reeves, Williamson	G 10
241	Renault	E 9
367	Reynolds	D 3
554	Richmond	I 1
366	Richview	G 9
967	Ridge Farm	J 6
1,054	Ridgway	I 10
173	Ridott	F 1
234	Ripley	D 5
917	Riverdale	J 2
2,456	River Forest	J 2
418	Rivergrove, Cook	J 2
1,702	Riverside	J 2
1,911	Riverton	F 6
312	Riverview, Cook	J 2
1,311	Roanoke	G 4
466	Roberts	I 4
3,863	Robinson	J 7
2,732	Rochelle	G 2
444	Rochester	F 6
275	Rockbridge	E 7
122	Rock City	F 1
1,101	Rockdale, Will	J 3
358	Rockefeller	I 1
2,657	Rock Falls	F 2
55,185	Rockford	G 1
28,926	Rock Island	E 3
841	Rockton	G 1
140	Rockwood	F 10
233	Rome	F 4
98	Romeoville, Will	J 3
2,171	Roodhouse	E 7
229	Rose Hill	I 7
882	Roseville	D 4
609	Rosiclare	I 11
1,422	Rossville	J 5
182	Round Lake	I 1
357	Royalton	G 10
138	Ruma	E 9
2,422	Rushville	D 5
257	Russellville	K 8
754	Rutland	G 4
336	Sadorus	I 6
388	Sailor Springs	I 8
2,669	Salem	H 8
112	Saline Mines	I 10
1,563	Sandoval	G 8
2,557	Sandwich	G 11
446	San Jose	F 5
49	Sato, Jackson	G 10
357	Saunemin	H 4
3,691	Savanna	E 1
445	Sawyerville, Macoupin	F 7
805	Saybrook	H 5
388	Scales Mound	E 1
516	Schram City, Montgomery	G 7
160	Sciota	D 4
301	Scottville	F 7
236	Sears, Rock Island	D 3
326	Seaton	D 3
1,370	Seatonville	G 3
358	Secor	G 4
1,292	Sesser	G 9
594	Shabbona	G 2
633	Shannon	F 1
1,863	Shawneetown	I 10
1,009	Sheffield	F 3
3,590	Shelbyville	H 7
1,143	Sheldon	J 4
506	Sheridan	H 2
441	Shermerville, Cook	J 2
906	Sherrard	D 3
395	Shiloh	F 9
392	Shipman	E 7
306	Shobonier	G 8
291	Shumway	H 7
385	Sibley	I 4
741	Sidell	J 6
481	Sidney	I 6
308	Sigel	H 7
1,163	Silvis	D 3
161	Simpson	H 11
395	Sims	I 9
301	Smithboro	G 8
389	Smithfield	E 5
380	Smithton	F 9
591	Somonauk	H 2
1,018	Sorento	F 8
552	South Chicago Heights, Cook	J 2
580	South Elgin, Kane	I 2
1,065	South Holland, Cook	J 2
2,403	South Wilmington	I 3
461	Sparland	F 3
3,081	Sparta	F 9
308	Spaulding	F 6
249	Spillertown	H 10
119	Spring Bay, Woodford	G 4
418	Springerton	I 3
61,120	Springfield	G 6
334	Spring Forest, Cook	J 2
203	Spring Grove	I 1
7,035	Spring Valley	F 3
1,065	St. Anne	J 3
187	St. Augustine	E 4
4,046	St. Charles	I 2
915	St. David	F 5
1,227	St. Elmo	H 7
1,391	St. Francisville	J 8
534	St. Jacob	F 8
370	St. John	G 9
681	St. Joseph	I 5
328	St. Libory	F 9
450	Ste. Marie	I 8
313	St. Peters	G 8
793	Standard, Putnam	G 3
525	Stanford	G 5
5,048	Staunton	F 8
708	Steeleville	F 10
2,161	Steger	J 3
7,467	Sterling	F 2
353	Steward	H 2
720	Stewardson	H 7
1,096	Stockton	E 1
1,118	Stonington	G 6
488	Stoy	J 8
526	Strasburg	H 7
277	Strawn	I 4
14,304	Streator	H 3
762	Stronghurst	D 4
287	Sublette	G 2
2,621	Sullivan	H 6
337	Summerfield, St. Clair	F 9
949	Summit	J 2
1,413	Sumner	J 8
889	Swansea, St. Clair	F 9
97	Swedona	D 3
3,926	Sycamore	H 2
157	Symerton	J 3
544	Table Grove	D 5
742	Tallula	F 6
910	Tamaroa	G 9
400	Tamms	G 11
849	Tampico	F 2
380	Taylor Springs	G 7
5,446	Taylorville	G 6
274	Tennessee	D 5
359	Tessville, Cook	J 2
592	Teutopolis	I 7
318	Thawville, Iroquois	J 4
1,012	Thayer	F 6
717	Thebes	F 11
321	Thomasboro	I 5
573	Thompsonville	F 7
487	Thomson	E 2
1,030	Thornton, Cook	J 2
774	Tilden	F 9
710	Tilton	J 5
158	Time, Pike	D 6
309	Tinley Park, Cook	J 2
857	Tiskilwa	F 3
900	Toledo	I 7
760	Tolono	I 6
2,407	Toluca	G 4
483	Tonica	G 3
130	Topeka	E 5
514	Torino, Will	J 3
1,208	Toulon	F 3
404	Towanda	H 4
1,040	Tower Hill	G 7
782	Tremont	F 5
1,694	Trenton	F 8
1,447	Troy	F 8
289	Troy Grove	H 3
2,453	Tuscola	I 6
670	Ullin	G 11
432	Union	I 1
2,918	Upper Alton	E 8
9,889	Urbana	I 5
976	Utica	G 3
2,974	Vandalia	G 8
406	Varna	G 4
160	Venedy	F 9
3,718	Venice	E 8
342	Vergennes	G 10
287	Vermilion	J 6
1,118	Vermont	G 5
333	Vernon	G 8
557	Versailles	D 6
334	Victoria	E 3
1,124	Vienna	H 11
1,828	Villa Grove	I 6
760	Viola	D 3
4,000	Virden	F 7
1,501	Virginia	E 6
270	Waggoner	F 7
261	Waldron	J 3
763	Walnut	F 3
169	Walshville	F 7
498	Wapella	G 5
1,331	Warren	F 1
504	Warrensburg	G 6
2,254	Warsaw	C 5
7‾7	Washburn	G 4
1,530	Washington	G 4
444	Wataga	E 3
2,091	Waterloo	E 9
398	Waterman	H 2
525	Watertown, Rock Island	D 3
2,476	Watseka	J 4
330	Watson	H 8
368	Wauconda	I 1
20,244	Waukegan	J 1
1,538	Waverly	E 6
620	Wayne City, Dupage	I 2
846	Waynesville	G 5
521	Weldon	H 5
295	Wellington	J 4
1,442	Wenona	G 3
266	West Brooklyn	G 2
2,378	West Chicago	I 2
905	Western Springs, Cook	J 2
927	Westfield	J 7
2,111	West Frankfort	H 10
4,948	West Hammond, Cook	J 2
292	West Point	C 5
725	West Salem	I 8
2,607	Westville	J 6
218	Wetaug	G 11
1,593	Wethersfield, Henry	E 3
3,423	Wheaton	I 2
255	Wheeler	I 7
260	Wheeling	I 1
353	White Ash, Williamson	G 10
421	White City, Macoupin	F 7
2,854	Whitehall	D 7
480	Williamsfield	E 4
648	Williamson, Madison	F 8
600	Williamsville	F 6
1,082	Willisville	F 10
444	Willow Hill	I 7
4,943	Wilmette	J 1
1,450	Wilmington	I 3
204	Wilmington, Greene	E 7
1,639	Winchester	E 6
987	Windsor	H 7
660	Windsor	D 3
415	Winnebago	G 1
3,168	Winnetka	J 1
439	Winthrop Harbor, Lake	I 1
426	Winslow	F 1
2,170	Witt	G 7
175	Woodburn, Macoupin	F 7
692	Woodhull	E 3
295	Woodland	J 4
315	Woodlawn	G 9
84	Woodriver	E 8
257	Woodson	E 6
4,331	Woodstock	H 1
1,082	Worden	F 8
872	Wyanet	F 3
1,506	Wyoming	F 3
634	Xenia	H 8
586	Yates City	E 4
169	York	J 7
431	Yorkville	I 2
4,789	Zion	J 1

10,000. Chicago had 2,185,283; 11 others had over 25,000 but less than 100,000; the rest had between 10,000 and 25,000. On 1 July 1916 the estimated population of the five leading cities was: Chicago, 2,497,722; East Saint Louis, 74,708; Peoria, 71,458; Springfield, 61,120; Rockford, 55,185. In July 1915 some of the other cities ranked as follows: Decatur, 38,526; Joliet, 37,472; Quincy, 36,764; Aurora, 33,613; Danville, 31,554; Evanston, 28,012; Elgin, 27,844; Bloomington, 27,054; Moline, 26,927; Galesburg, 23,923; Alton, 22,483; Belleville, 21,144; Waukegan, 19,471; Freeport, 19,293; Cicerotown, 19,102; Cairo, 15,593; Jacksonville, 15,456; Kankakee, 14,190; Champaign, 14,171; Kewanee, 13,517; Mattoon, 12,400; La Salle, 12,110; Lincoln, 11,685. Within the last few years the following cities have probably passed the 10,000 mark: Canton, Monmouth, Maywood, Ottawa, Urbana, Mount Vernon and De Kalb.

Education.— Illinois has an excellent public school system. Education is free and compulsory for children from 7 to 14. In 1860, Illinois had 464,304 pupils, 8,223 male teachers, 6,485 female teachers, and expended $1,512,211 in wages, and $2,259,868 for all school purposes. For the school year ending June 1915 Illinois had an estimated number of 1,493,473 children from 5 to 18; 1,064,221 enrolled, an average duration of 160 school days, 5,918 male teachers and 26,902 female teachers; she paid $23,179,650 in salaries, and expended for school purposes $39,508,058. During this period the average annual cost per pupil enrolled increased from less than $5 to about $40, and the average yearly wage of the teacher increased from a trifle over $100 to about $700. Religious education and training cannot be given in the public schools, but they are fairly well cared for by the churches, which in the order of their strength are Roman Catholic, Methodist, Lutheran, Baptist, Presbyterian and Disciples of Christ.

Higher education is provided for by a number of normal schools, colleges and universities. The public normal schools of the State are located as follows: The State Normal University at Normal; the Southern Illinois State Normal University at Carbondale; the Northern Illinois Normal School at De Kalb; the Eastern Illinois Normal School at Charleston; and the Western Illinois Normal School at Macomb. The Chicago Normal School, since 1896, has been maintained by appropriations made by the Chicago board of education. Most of the teachers of the State receive at least part of their training in these schools. In 1916 there were 147 male teachers, 171 female teachers, 1,893 male students and 7,548 female students in the six public normal schools. There were, in addition, four small private normal schools which contained 37 male teachers, 44 female teachers, 164 male students and 437 female students.

In 1915 Illinois had 32 universities, colleges and schools of technology. These employed 2,056 male professors and instructors and 485 female. In the preparatory departments there were 2,983 male students and 1,306 female; in the collegiate departments there were 8,764 male students and 7,247 female; the resident graduate students numbered 1,679 male and 1,017 female. The total receipts, exclusive of additions to the endowment, were $8,846,776. Of these 32 institutions, four were exclusively for women and four for men. In 1916 the State had 15 theological schools with 1,656 students, 11 law schools with 3,136 students, 8 medical schools with 2,264 students, 3 dental schools with 1,294 students, 3 schools of pharmacy with 339 students, and 2 schools of veterinary medicine with 650 students. The three great universities of the State are Northwestern, Chicago and Illinois. The latter stands at the head of a liberal system of free public education. It was incorporated as Illinois Industrial University 28 Feb. 1867, and it was opened 2 March 1868 at Urbana. The name was changed in 1885. From 4 teachers and 77 pupils in 1868, it increased to 54 teachers and 418 pupils in 1889, and to 868 teachers and officers and 6,828 students 21 Feb. 1917. About 558 of these students were in the schools of medicine, dentistry and pharmacy at Chicago.

Charitable Institutions.— Until recent times each charitable institution was under the control of a separate board of trustees, managers or commissioners, with some supervision in most cases by an unpaid State Board of Public Charities. By the act of 1909, repassed in 1912 and in effect 1 July 1912, however, all the «charitable institutions» were placed under the direct management of a single salaried Board of Administration, and subject to the visitation and inspection of an unpaid State Charities Commission. The five members of the single board of management were to be appointed by the Governor for a term of six years, confirmed by the Senate, and required to give all their time to the work. Their salary was to be $6,000. The State Treasurer is treasurer for all the institutions. One member of the Board of Administration, as fiscal supervisor, was to be business manager for all the institutions. Supplies were to be purchased for all on competitive bids, and a uniform system of accounts and purchases was to be maintained. One member of the Board of Administration was required to be a trained specialist in the care of the insane, who form the largest group in the State institutions. In addition to this highly centralized system of administration, there were the following elaborate provisions for the inspection and investigation of the institutions: by the Board of Administration itself; by the unpaid Charities Commission, which acts largely through the executive secretary; and by the local boards of visitors for each institution. The Charities Commission was to have the supervisory and visitorial power of the old Board of Public Charities. Its duty was purely advisory and recommendatory, based upon independent investigation into the whole field of public and private charity. The law required the Commission to inspect all State charitable institutions, all jails, almshouses, workhouses, houses of correction, all private institutions for mental and nervous diseases and for the care of children, to which the Board of Administration issues its license. In brief, the Commission had, by law, supervisory and inspectional powers over all institutions, for whose management and administration the Board of Administration was responsible. The only executive or administrative duty belonging to the Commission was that involved in the collection of criminal statistics. The Illinois Administrative Code, effective 1 July 1917 (see *Government*) again modified these arrangements. The department of public welfare now has charge of the charitable, penal and reformatory institutions of the State. It performs the functions of the old Board of Administration, three boards of commissioners and managers for the two State penitentiaries and reformatory and their subordinate officials, the board of prison industries, and board of pardons. The Code makes provision for an alienist, a criminologist, a fiscal supervisor, a superintendent of charities, a superintendent of prisons, a superintendent of pardons and paroles, and an unpaid board of public welfare, which takes the place of the present State Charities Commission.

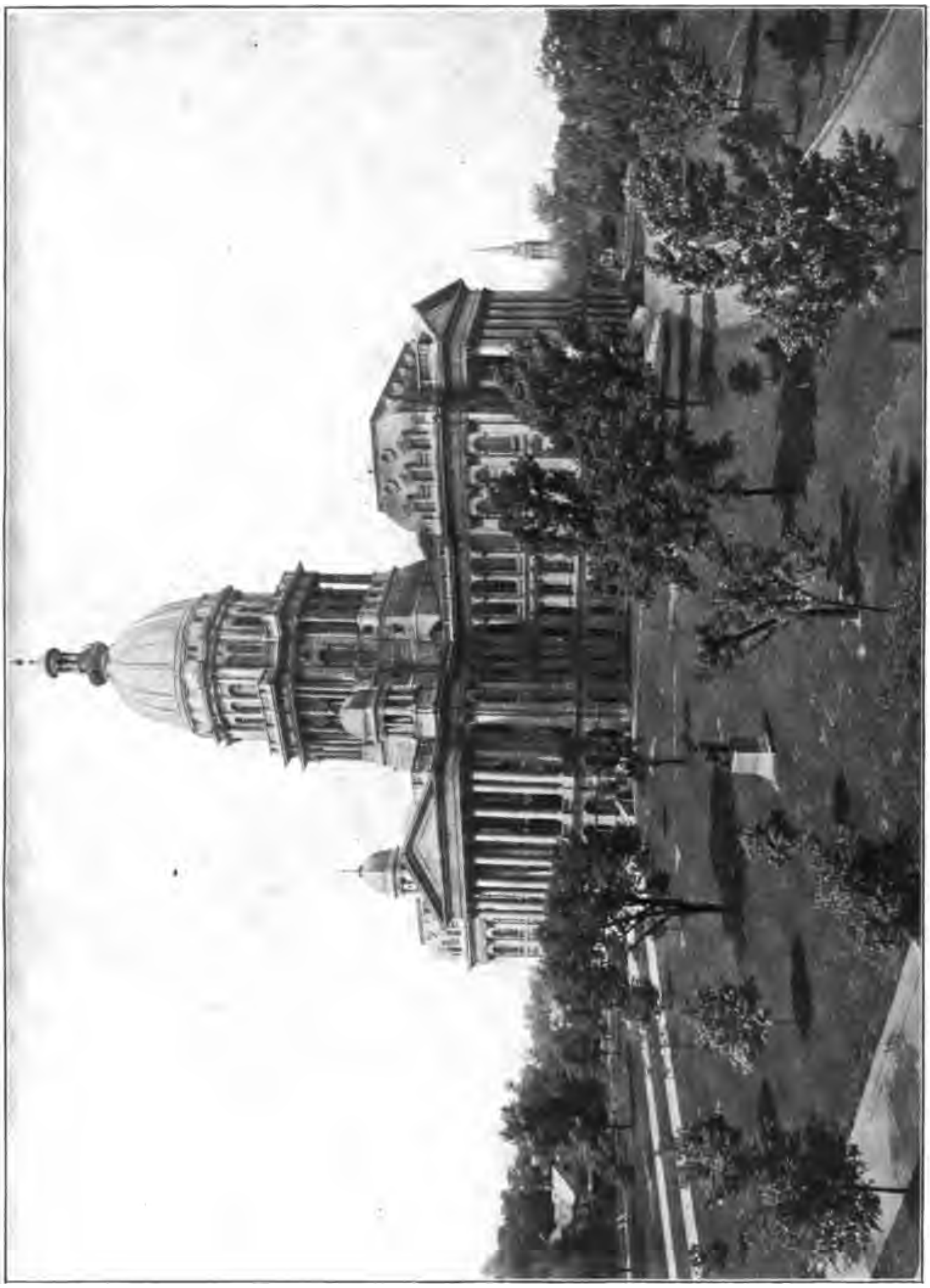
In 1916 there were 21 charitable institutions under the management and control of the Board of Administration. They included the State hospitals or asylums for the insane at Chicago, Kankakee, Elgin, Moline, Jacksonville, Alton and Anna; the hospital for the criminal insane at Chester; the school and colony for the feeble-minded at Lincoln; the epileptic colony at Dixon; the Psychopathic Institute with clinical laboratory at the Kankakee State Hospital; the Soldiers' and Sailors' Home at Quincy; the Soldiers' Orphans' Home at Normal; the Soldiers' Widows' Home at Wilmington; the School for the Blind and the School for the Deaf at Jacksonville; the Training School for Girls at Geneva; the School for Boys at Saint Charles; and the Charitable Eye and Ear Infirmary and the Industrial Home for the Blind at Chicago. Twenty-one thousand people were housed in these institutions, and 75,000 additional people received treatment annually at the Charitable Eye and Ear Infirmary in Chicago. Farms are operated in connection with most of the institutions, and over 1,500 head of cattle are maintained on the institution farms. Kindness is practised towards the inmates, and the 3,500 employees are well treated. The latter have an eight hour day, and one day's rest out of seven. The cost of maintenance is about $5,500,000 yearly.

Penal Institutions.— The Illinois State Reformatory, located at Pontiac, has excellent buildings and appointments for the care of its inmates. Under the law no one can be admitted who has reached the age of 21 at the time of the commission of the offense for which he is sentenced. Trade schools and a farm are provided for and every effort practicable is made to reform the inmates. The Illinois State penitentiary is located at Joliet and the Southern Illinois penitentiary at Chester. The State legislature appropriated $2,803,014 for the State penal and reformatory institutions for the biennium beginning 1 July 1917. The latest statistics at hand show that on 1 Jan. 1910 Illinois had 5,111 sentenced prisoners in penal institutions or 90.6 per 100,000 of population. Of this number, 3,000 were supposedly native white, 1,197 foreign born white, 911 negro, and three other colored persons. During that year 27,942 were committed to prison, or 495.5 per 100,000 population.

Corporations.— The first corporation was the Bank of Illinois, located at Shawneetown and chartered 28 Dec. 1816. Within the 100 years since that time, over 93,000 corporations have been created. Between the adoption of the Constitution of 1818 and that of 1848, about 2,700 corporations were created by special acts. On 16 Dec. 1824 the first statute in the nature of a general corporation act was approved. Manufacturing companies could be created by filing articles of incorporation with the secretary of state at a cost of 75 cents. This statute, however, remained a dead letter. The Constitution of 1848 authorized the creation of corporations by general law, and prohibited their creation by special act, except for municipal purposes and in cases where the general assembly thought that the objects of the corporation could not be obtained under general laws. Corporations, nevertheless, were still created by special acts, and the double system lasted till 1870. Then, because of the numerous evils arising under the system, the new Constitution prohibited the legislature from creating corporations by special act except for charitable, educational, penal or reformatory purposes, and these corporations were to remain under the control of the State. The first corporation created under a general law was the Illinois and Mississippi Telegraph Company, whose articles were filed 2 May 1849. From that time until 1 July 1872, when the present general incorporation act went into effect, 2,200 corporations filed articles in the office of the Secretary of State. This was an average of less than 100 corporations a year. The average now is about 3,300 per year. On 1 May 1916, the total number of corporations licensed to do business at one time or other in the State was 93,908. Not over 5,000 of these were created in the first half century of the State's history, and only 30,380 were chartered in the first 75 years. In the last 25 years about 60,000 corporations have been registered. The greatest increase took place in the decade from 1882 to 1892, which showed a gain of nearly 300 per cent over the previous 10 years. The increase is now comparatively uniform, each decade showing a gain of about 25 per cent. In 1915, domestic corporations paid fees amounting to $222,756.16 and foreign corporations paid $97,314.90. The law requires corporations organized for profit to make a yearly report, and in Feb. 1915, 15,900 Illinois corporations and 2,280 foreign corporations reported to the secretary of state, making an apparent total of 18,180 corporations doing business then. These figures, however, do not include banks, home building and loan associations, which report to the auditor of public accounts, and insurance companies, which report to the superintendent of insurance. Moreover, annual reports are not required from railroads. For these reasons, it seems fair to assume that about 30,000 corporations are now active in the State.

Illinois now ranks next to New York and Pennsylvania in the paid-in capital for national banks. This system, established 25 Feb. 1863, was a success and achieved the purposes for which it was primarily created; the establishment of a market for government bonds, the establishment of a uniform currency, and the abolition of «wild cat» currency. The National Banking system followed, in Illinois, the «Free Banking Law» of 1851 under which 115 banks of issue were in operation just prior to the Civil War; these banks issued nearly 1,000 different kinds of bills and counterfeiting was easy. The new law remedied these evils. Banking showed a steady growth, though slow

ILLINOIS



State Capitol at Springfield

at first. From 14 Oct. 1900 to 31 Oct. 1915, 305 national banks with a total capital of $20,333,500 were organized. These banks fall into three general classes: those with a capital of $25,000, those with a capital of $25,000 to $50,000, and those with a capital of $50,000 or over. During the time indicated, 182 banks of the first class with a total capital of $4,500,000, 21 of the second class with a total capital of $733,500, and 102 of the third class with a capital of $15,050,000 were organized. On 2 Sept. 1915, 470 national banks reported; their combined capital was $76,105,000. Other banks also are strong. Thus, on 23 June 1915, saving deposits in Illinois State banks and trust companies aggregated $294,534,096.83.

Some provisions of the laws, other than the few indicated in the historical sketch above, are: no State bank shall be created and the State shall not own stock in any corporation for banking purposes; every stockholder in a banking corporation shall be individually liable to its creditors for double the amount of his stock; the rolling stock and all other movable property of all railroads in the State are to be considered personal property, and subject to execution for the debts of such companies; railroad corporations are prohibited from consolidating with parallel or competing lines; all railroads in the State are declared to be public highways, and free to all persons for the transportation of their persons and property thereon, under such regulations as may be prescribed by law — the general assembly to establish reasonable maximum rates of charges for the transportation of passengers and freight; the right of eminent domain by the State against such corporations shall never be abridged; the general assembly by appropriate legislation shall prevent unjust discrimination and extortion in the rates of passenger and freight tariffs on all railroads in the State; appropriate legislation is authorized for the protection of producers, shippers and receivers of grain and produce; the general assembly is prohibited from releasing the Illinois Central Railroad Company from its charter obligation to pay the State the agreed percentage of its gross earnings; and no county, city, town or township is permitted to become a subscriber to the capital stock of any railroad, or private corporation, or to make donations to, or loan its credit in aid of any such corporation.

Transportation.— Illinois is especially favored for commerce. The early French settlers came to the State by way of the Saint Lawrence River and the Great Lakes; many of the English settlers came by way of the Ohio River and its tributaries. Nearly three-fourths of its boundaries are navigable rivers. It has 4,000 miles of river navigation. About 65 miles of the shore line of Lake Michigan lie within the State. The Mississippi River is connected with the Great Lakes by means of the Illinois and Michigan Canal, which extends from the Chicago River to LaSalle on the Illinois River, a distance of nearly 100 miles. The Chicago Drainage Canal, extending from Lake Michigan to the Des Plaines River and thence to the Illinois River, gives connection with the Mississippi. Still another canal connects the Illinois River at Hennepin, a few miles below LaSalle, with the Mississippi River at Rock Island. The first railway constructed in the West was the Northern Cross Railroad from Meredosia on the Illinois River to Springfield. This was completed in 1842, but in 1850 there were only 111 miles of railroad in the State. The Illinois Central Railroad was completed in 1856. Railways were constructed rapidly, and by 1870 Illinois had a greater railroad mileage than any other State in the Union. The first Railway and Warehouse Commission in the United States, with authority to fix freight and passenger rates, was established in Illinois in 1871. In 1907 the legislature passed a bill making it unlawful for any railroad to charge more than two cents a mile for carrying passengers between points within the State provided tickets were bought before entering the cars; otherwise three cents might be charged. In 1915, Illinois had over 12,000 miles of railroad and nearly 4,000 miles of electric railways. The roads having the longest mileage 30 June 1915, were the Illinois Central, 2,024; the Wabash, 669; the Cleveland, Cincinnati, Chicago and Saint Louis, 650; the Elgin, Joliet and Eastern, 327, and the Gan Dalia Railroad, 303.

Manufactures.— Illinois is easily the most important manufacturing State west of the Alleghanies. Three factors have contributed largely to this — abundant raw materials, cheap coal and adequate transportation facilities both by water and by rail.

In 1849, 11,559 wage-earners or 1.4 per cent of the population were employed in manufactures; in 1879, 144,727 or 4.7 per cent; in 1909, 465,764 or 8.3 per cent. The gross per capita value of the products increased from $19.42 in 1849 to $340.38 in 1909, and the percentage which the manufactures represented of the total value of the products of manufacturing industries in the United States from 1.6 in 1849 to 9.3 in 1909. Illinois ranked fifth in the value of manufactures in 1849, and third in 1909. In the last named year, she had 18,026 manufacturing establishments. These employed 561,044 persons, paid out $364,768,000 in salaries and wages, turned out products valued at $1,919,277,000 from materials costing $1,160,927,000, and thereby added a value of $758,350,000 in the process of manufacturing. These figures do not include the government arsenal at Rock Island, which, in 1909, employed 1,698 wage-earners and reported the value of its products at $3,114,338.

In 1909, the 21 leading industries with products valued at over $20,000,000, with the number of their establishments and the average number of workers employed were as follows: (1) Slaughtering and meat packing, $389,595,000 (28.4 per cent of the total product of the United States), 109 and 26,705; (2) foundry and machine shop products, $138,579,000, 1,178 and 52,266; (3) clothing, men's, including shirts, $89,473,000, 715 and 36,152; (4) printing and publishing, $87,247,000, 2,608 and 28,644; (5) iron and steel, steel works and rolling mills, $86,608,000, 24 and 17,584; (6) agricultural implements, $57,268,000 (39.1 per cent of the total product of the United States), 79 and 19,240; (7) distilled liquors, $55,200,000 (27 per cent of the total product of the United States), 9 and 750; (8) flour-mill and grist mill products, $51,111,000, 461 and 2,464; (9) lumber and timber products, $44,952,000, 814 and 16,567; (10) iron and steel, blast furnaces, $38,300,000, 6 and 2,493; (11) bread and other bakery products $36,118,000, 2,099 and 8,611; (12) cars and general shop construction and repairs by steam railroad companies, $32,229,000, 73 and 23,131; (13) liquors, malt, $28,449,000, 106 and 4,398; (14) furniture and refrigerators $27,900,000, 267 and 13,575; (15) cars, steam railroad, not including operations of railroad companies, $27,001,000, 28 and 10,945; (16) electrical machinery, apparatus and supplies, $26,826,000, 143 and 9,641; (17) copper, tin and sheet-iron products, $22,823,000, 483 and 7,473; (18) tobacco manufactures, $21,870,000, 1,944 and 8,034; (19) gas, illuminating and heating, $21,052,000, 78 and 6,301; (20) paint and varnish $20,434,000, 74 and 1,792; (21) soap, $20,181,000, 34 and 2,188. The average number of wage-earners in 1909 was 465,764. Of this number 382,691 were males 16 years of age and over, 76,156 were females 16 years of age and over and 6,917 were under 16 years of age. The percentages for the three were 82.2, 16.3 and 1.5. The proportion of wage-earners under 16 in all manufacturing industries combined was only one-half as great in 1909 as in 1899. There was a moderate increase during the decade, however, in the proportion of female wage-earners 16 years of age or over, while the proportion of males 16 years of age or over showed a slight decrease. In 1909, 84.2 per cent of the workers employed in the men's furnishing goods industry were females 16 years of age or over, 75.4 per cent of those in the millinery and lace goods industry were females 16 or over, and 67.4 per cent of the workers in the women's clothing industries belonged to this class. Other industries employing large numbers of female wage-earners 16 years of age and over were: printing and publishing, slaughtering and meat packing, and the manufacture of clocks and shoes, electrical machinery, tobacco products and fancy and paper boxes. Of the wage-earners under 16, 46.9 per cent were employed in seven industries. These were the men's clothing industry with an average of 995; printing and publishing, with 739; the manufacture of fancy and paper boxes, with 410; the boot and shoe industry, with 334; the manufacture of pianos and organs, with 309; the confectionery industry, with 205; and foundries and machine shops, with 202. In the manufacture of patent medicines and compounds, the proportion of children in the total number of wage-earners was highest — 8.1 per cent — but the average number employed was only 151.

The value of the total manufactured product in Chicago alone, in 1909, was $1,281,171,000 or about two-thirds of the total. Peoria and Joliet held second and third place among the manufacturing cities. In 1914, Illinois had 18,388 establishments, 15,854 proprietors and firm members, 95,130 salaried employees, 506,943 wage-earners, and $1,943,836,000 invested capital. These manufacturing industries paid $128,478,000 in salaries and $340,910,000 in wages, used material costing $1,340,183,000 and turned out products valued at $2,247,323,000, thereby adding a value of $907,140,000. The total value of the product has practically doubled within 15 years, the value being only $1,259,730,168 in 1899.

Agriculture, Mining, etc.— Illinois takes very high rank as an agricultural State; 32,471,000 acres under cultivation being reported for 1910, as compared with 32,795,000 in 1900, a decrease of 1 per cent. In 1910, the total number of farms in the State was 250,853; the estimated value of the land and buildings was $3,511,194,000 as compared with $1,765,582,000 in 1900. The increase was 99 per cent. In 1900 the average value of a farm with its equipment was $7,600; in 1910, $15,505. The average value of the land per acre in the two census years was $46.17 and $95.02. The total value of farm lands was $1,514,114,000 and $3,081,564,000 or a gain of 104 per cent. The value of farm buildings in the two years was $251,468,000 and $429,630,000, and the increase was 71 per cent. The larger farms are generally in the north and the smaller in the extreme southern portion of the State.

The census of 1880 showed the number of tenant farmers in Illinois to be larger than in any other State of the Union, and quite a little capital was made of the "eighty thousand tenants" then operating Illinois farms. In 1910, Illinois had 104,379 tenant farms out of a total of 251,872, but her rank had sunk to eighth. In 1910, owners operated 145,107 farms embracing 17,787,063 acres, which, with buildings, were valued at $1,765,992,310; managers operated 2,386 farms embracing 554,463 acres, and valued at $65,008,033; tenants operated 104,379 farms embracing 14,177,411 acres, and valued at $1,691,792,227. The percentage of farms operated by owners was 57.61, by managers 0.95, and by tenants 41.44. The average size of the farms operated by owners was 122.58 acres, by managers 234.06, and by tenants 135.82. The average value of the farms and buildings operated by owners was $12,170.28, by managers $27,245.61 and by tenants $16,208.17. Of the 145,107 farms operated by owners, 86,713 were free from mortgage, 55,792 were mortgaged, and 2,602 were not reported. The per cent reported as mortgaged was thus 39.2. The per cent in that year ranged from 5.4 in New Mexico to 51.8 in Iowa; for the United States as a whole it was 33.6. Illinois had 36,938 farms operated by owners owning the entire farm. The value of the land and buildings was $454,857,222, and the amount of debt was $115,799,646. The average value of each farm was $12,314, and the average debt $3,135, the ratio of debt to the value being 25.5. At the same time the United States had 1,006,511 farms operated by owners owning the entire farm. The value of land and buildings was $6,330,236,951 and the amount of debt, $1,726,172,851. The average value per farm was $6,289 and the average debt was $1,715, the ratio of debt to the value being 27.3. For Illinois, the ratio of debt to the value of the farm had decreased from 34.6 in 1890 to 25.5 in 1910; for the United States as a whole the decrease was from 35.5 to 27.3.

Illinois has an active live stock industry. On 1 Jan. 1917, there were 1,452,000 horses (farm animals) valued at $153,912,000; 150,000 mules valued at $17,250,000; 1,057,000 milch cows valued at $71,876,000; 1,251,000 other cattle valued at $54,168,000; 898,000 sheep valued at $7,363,000 and 4,440,000 swine valued at $60,883,000. In 1916, Illinois produced 306,800,000 bushels of corn valued at $257,712,000; 172,095,000 bushels of oats valued at $87,768,000; 16,225,000 bushels of wheat valued at $26,771,000 (in 1915 the figures were 53,250,000 and $53,-

200,000); 4,495,000 tons of hay valued at $50,794,000; and 7,250,000 bushels of Irish potatoes valued at $12,978,000 (in 1909 the figures were 14,924,000 and $9,104,000). In 1909, Illinois produced 1,125,000 pounds of tobacco valued at $123,750; in 1916, the production was only 525,000 pounds and the value $52,000. In 1916, 1,616,000 barrels of apples (4,716,000 in 1915), 780,000 bushels of peaches, and 354,000 bushels of pears were produced. The wool production of Illinois in 1909 was 4,725,000 pounds, and the value of the product was $1,296,540. In 1915, 3,975,000 pounds were produced and the average price was 25 cents a pound; in 1916, only 3,855,000 pounds were produced, but the average price was 30.1 cents and the value was about $1,160,355. At the time of the last census, Illinois was producing about 125,000 feet of lumber yearly at a valuation of over $2,500,000. At the same time, her fisheries employed about 5,000 persons and yielded a product valued at $1,500,000.

In 1909, Illinois ranked next to Pennsylvania in the value of the products of mining industries. The gross value was $76,658,974; the net value, $76,556,994. Bituminous coal mining with a product valued at $53,030,545 was easily the leader. The petroleum and natural gas wells with a product worth $18,883,102 ranked second. The output of zinc in 1913 was about 2,236 short tons and the value was $250,432; flour-spar was produced to the amount of 85,854 short tons and a value of $550,815; the limestone and sandstone output was valued at $4,140,953; and clay products (bricks, tiles and pottery) were valued at $15,195,874. In 1913 the total mineral product was valued at $131,825,221; the average year since the last census, however, has seen a product worth over $100,000,000. In 1915, 2,447,220 long tons of pig iron, 5,156,869 barrels of cement, $350,371 worth of natural gas, 24,942,701 barrels of petroleum, 1,686,998 short tons of coke, and 58,829,576 short tons of coal were produced. The coal fields of Illinois cover an area of about 42,900 square miles. Since 1882 very careful reports of coal production have been kept. In that year, 11,017,069 tons were produced, and 20,290 men employed; in 1914 the figures stood 60,715,795 tons and 80,035 men. The leading counties in the latter year were: Williamson, 7,681,006 tons; Franklin 6,595,799; Sangamon, 5,723,046; Macoupin, 4,981,057; Saint Clair, 4,009,258. All were in the southern or south central part of the State.

Chicago is the great distributing and receiving point, due partly to lake transport and excellent railroad facilities. The former brings millions of tons of iron ore, and millions of bushels of oats, wheat and maize every year. Receipts by lake transport for Chicago, in 1914 included 586,134,000 pounds of fresh beef, and the shipment, 1,027,327,000 pounds. During the year 1915, 107,471,640 dozen eggs, 180,303,840 pounds of butter, 9,063,000 barrels of flour, 4,648,000 bushels of rye, 26,167,000 bushels of barley, 70,704,000 bushels of wheat, 95,357,000 bushels of corn, and 133,475,000 bushels of oats were received in Chicago. The value of the live stock received at the stock yard in the same year was $370,938,156. Shipments received by down-town packers increased the total to $379,099,642. The official valuation of livestock received at the Chicago Stock Yards that year was: Cattle, $192,116,472; calves, $5,714,075; hogs, $120,349,047; sheep, $23,044,562; horses, $29,754,000.

Everything considered Illinois is one of the wealthiest States in the Union. In 1904, the estimated true value of all property and of specified classes of property stood as follows: Real property and improvements, $5,468,492,926; live stock, $268,731,540; farm implements and machinery, $48,593,486; manufacturing machinery, tools and implements, $227,543,320; gold and silver coin and bullion, $150,074,503; railroads and their equipment, $805,057,000; street railways, shipping, waterworks, etc., $327,591,493; all other $1,520,471,923; total $8,816,556,191. For these same items, in the order named, the figures for 1912 stood: $10,056,319,512; $386,701,265; $79,473,427; $451,299,068; $205,185,274; $926,403,787; $784,713,023; $2,640,354,876; $15,484,450,232. In the first named year, New York and Pennsylvania were ahead of Illinois, but in 1912 Illinois stood second to New York.

Constitution.— Three constitutions have been in force in Illinois since its admission as a State. The first was formed by a convention of 32 delegates from the 15 counties of the territory, which met at Kaskaskia in August 1818. This constitution, under which the State was admitted; remained the organic law of Illinois for 30 years, or until the adoption of the constitution of 1848. In the meantime, the State had gradually increased in wealth and in population. Many new counties had been organized, and the northern boundary of actual settlement had been extended from the county of Madison to the Wisconsin line. Chicago and other cities unknown to the framers of the first constitution had sprung into being. A futile attempt to procure the calling of a convention to frame a new constitution was made in 1823. In 1846, the question of calling a convention was again submitted by the legislature; the returns showed a large majority favorable, and delegates were accordingly chosen in April 1847. This convention, consisting of 162 members, assembled at Springfield in June of that year and its work was concluded 31 August. Unlike the first constitution, this one was submitted to the people. It met with popular approval and by its terms went into operation on the first Monday of April 1848; it remained in force until the adoption of the present constitution. The latter was formulated by a convention of 85 members which assembled in Springfield, 13 Dec. 1869. This constitution was submitted to popular vote and approved, and since August 1870, has been the fundamental law of the State. By a two-thirds vote in each House the general assembly may submit to the electors, the question of calling a convention to alter or amend the constitution, to be voted upon at the next general election; by the same vote in the general assembly proposed amendments to the constitution (without the intervention of a convention) may be submitted to the electors for adoption or rejection. One of the most important provisions of the present constitution is the division of the powers of the government into legislative, executive and judicial. The legislative power is prohibited from releasing the indebtedness, liability or obligation of any corporation or individual to the State or to any municipal corporation therein, and to authorize lotteries or gift enterprises for any purpose. Two important mandatory provisions upon the general assembly were incorporated in the constitution: One requiring legislation protecting coal miners, and the other the passage of liberal homestead and exemption laws. Under the former constitution, the State and people had suffered from special legislation. To cause the discontinuance of such legislation and the enactment of general laws when necessary, the general assembly was prohibited from passing local or special laws in any of the following cases, viz.: For granting divorces; changing the names of persons or places; laying out, opening, altering and working roads or highways; vacating roads, townplots, streets, alleys and public grounds; locating or changing county seats; regulating county and township affairs; regulating the practice in courts of justice; regulating the jurisdiction and duties of justices of the peace, police magistrates and constables; providing for changes of venue in civil and criminal cases; incorporating cities, towns or villages or changing or amending the charter of any town, city or village; providing for the election of a board of supervisors; summoning and impaneling grand or petit juries; providing for the management of common schools; regulating the rate of interest on money; the opening and conducting of any election or designating the place of voting; the sale or mortgage of real estate belonging to minors or others under disability; the protection of game or fish; chartering or licensing ferries or toll bridges; remitting fines, penalties or forfeitures; creating, increasing or decreasing fees, percentage or allowance of public officers during the term for which said officers are elected or appointed; changing the law of descent; granting to any corporation, association or individual the right to lay down railroad tracks or amending existing charters for such purpose; granting to any corporation, association or individual any special or exclusive privilege, immunity or franchise whatever.

Government.— The supreme executive power of the State is vested in a governor, "who shall take care that the laws be faithfully executed." He must be 30 years of age and for five years next preceding his election a citizen of the United States, and of this State. His term of office is fixed at four years. Some of his powers are: Giving the general assembly information by message of the condition of the State at the commencement of each session, and recommending such measures as he deems expedient; convening, by proclamation, the general assembly upon extraordinary occasions; removing officers of his appointment for incompetency, neglect of duty or malfeasance in office; and granting reprieves, commutations or pardons after conviction for all offenses. He is commander-in-chief of the military and naval forces of the State — except when they are called into the service of the United States. He has a qualified veto power upon all bills passed by the general assembly, but bills may be passed over his veto by a two-thirds vote of each House. In case of his death, resignation, or conviction upon impeachment, the duties of his office fall upon the lieutenant-governor, who acts as president of the Senate. He, with the secretary of state, the attorney-general, the auditor of public accounts, the treasurer and the superintendent of public instruction, is elected in the same manner, and except the treasurer, for the same length of time as the governor; the treasurer's term is two years.

A significant change for efficient and economic government, which marks Illinois as the leader in this respect went into effect 7 March 1917. The primary object of the new law — "The Civil Administrative Code" — of Illinois was to reorganize and consolidate the numerous state administrative officers, boards and commissions into a limited number of state departments as in the national government. Nine principal departments — finance, agriculture, labor, mines and minerals, public works and buildings, public welfare, public health, trade and commerce, registration and education — are created. These departments will absorb the functions of 40 executive officers, 50 boards and commissions, and a larger number of subordinate officials. All of the officials are appointed by the governor with the consent of the senate and for a term of four years (with the exception of the normal school board). Several new positions are created, and the more important officers receive larger salaries — the directors receive from $5,000 to $7,000 each. The net reduction in official positions, however, is about 100. Persons in the classified service are assigned to positions in the new departments. At the head of each department is a director. Under the directors there are subordinate officials. These are: In the department of finance, four divisional heads; in the department of agriculture, besides a food standard commission, an assistant director and six divisional heads; in the department of labor, besides an industrial commission consisting of five officers, an assistant director and three divisional heads; in the department of mines and minerals, an assistant director, a mining board consisting of four officers and the director of the department, and a miners' examining board of three officers; in the department of public works and buildings, an assistant director and eight divisional heads; in the department of public welfare, an assistant director and six divisional heads; in the department of public health, an assistant director; in the department of trade and commerce, an assistant director and four divisional heads, besides the public utilities commission consisting of five officers; and in the department of registration and education, an assistant director, a superintendent of registration and a normal school board consisting of 10 officers with the director of the department and the superintendent of the public instruction. Advisory and non-executive boards were created as follows: A board of agricultural advisors and a board of state fair advisors, a general board of free employment advisors and local boards, five advisory boards in the department of public works, a board of public welfare commissioners, a board of public health advisors, and two advisory boards in the department of education and registration. The qualifications, powers and duties of all directors, assistant directors, division heads and members of advisory boards are specified in the law. The salaries of the officers created are also specified, but it is provided that members of advisory and non-executive boards shall not receive salaries. The law specifies the hours during which all public offices are to be kept open. The director of each department has authority to prescribe all necessary regulations for the conduct of his office. The Civil Service Law was not repealed, but no director needs to or should retain more employees than are necessary. All fees and funds received by any state officer or department are to be paid into the treasury within 10 days after their receipt. The governor is to submit to the general assembly, within four weeks after its organization, a budget containing the amounts recommended by him for the respective departments, offices and institutions and for all other public purposes together with the estimated total revenues and the amount to be raised by taxation.

The judicial powers of the State are vested in a Supreme Court, circuit courts, county courts, justices of the peace, police magistrates, and in such courts as may be created by law for cities and incorporated towns. The Supreme Court consists of seven judges and their term of office is nine years. The State is divided into 17 circuits, and the term of the circuit judges is fixed at six years. Inferior appellate courts of uniform organization and jurisdiction, and composed of circuit judges, have been created. The legislative power of the State is vested by the constitution in the general assembly which consists of the senate and house of representatives. Senators must be 25 years of age, and representatives 21; both must be citizens of the United States and five years resident of the State. No person convicted of infamous crime or a public defaulter is eligible as senator or representative or to any office of profit or trust in the State. In addition to the ordinary official oath, each senator and representative is required to swear in substance that his election has in no way been secured by bribery. The number of senators is fixed at 51, and of representatives at 153; minority representation is provided for in the election of representatives. Senators are elected for four years (about half retire every two years) and representatives for two. Their salary was fixed at $5 per day during the session by the constitution, but it may be and has been changed from time to time by legislative act. A majority of members elected to each house constitute a quorum. Bills may originate in either house subject to amendment in the other. No act is to embrace more than one subject and that is to be contained in the title. Every bill must be read at large upon three different days in each house, and upon final passage the yeas and nays must be taken on each bill separately. No money may be drawn from the treasury save in the pursuance of an appropriation made by law. The general assembly is permitted to make appropriations for expenditures incurred in suppressing insurrection or repelling invasion.

Local government is of two general types — rural and urban. In each county from 9 to 13 officers are elected. The most common officers are the county clerk, the county judge, the county treasurer, the clerk of the circuit court, the State's attorney, the sheriff, the coroner, the county superintendent of schools and the county surveyor (a statutory officer). Any county may adopt or discontinue the system of township organization, on petition and a popular vote. Eighty-five of the 102 counties in Illinois have the township system. In the 85 counties there are 1,430 civil townships, with an average area slightly less than 36 square miles. Most of these townships are decidedly rural, with a population of from 1,000 to 2,000, but except in Chicago, where the townships have been practically abolished, they include cities and villages within their limits; hence there are a number of townships which have from 10,000 to 60,000 people. Cook County, like those counties in which townships are not found, is governed by a Board of Commissioners. These towns have limited powers, much less than in New England, for the important matters attended to by the towns there are looked after in Illinois by the cities, villages and school districts. The townships are vested with corporate capacity, however, and may levy local taxes, make by-laws for a few enumerated purposes, vote to prohibit the granting of liquor licenses, and elect a number of officials for road and judicial administration and for the assessment and collection of taxes. The annual town meeting — of little importance — is held on the first Tuesday in April for the election of officers and the transaction of business. The ordinary town officers are supervisor, town clerk, assessor, collector, three commissioners of highways, and two to five justices of the peace and constables. Assistant supervisors are elected in the larger towns. The supervisor and assistant supervisors are members of the county board. The former acts also as town treasurer, and in many cases as overseer of the poor. The duties of the other officers are indicated fairly well by their titles. City government, until recently, was carried on largely under the authority of a mayor and a council, the former being an executive with appointive and veto power and the latter a legislative body. Chicago has created separate municipalities for different functions. In 1915 it had 22 governments and its citizens voted for 250 officials. Besides the mayor and councilmen, Chicago voters elected the city clerk, city treasurer, 31 municipal judges, and the bailiff and clerk of the municipal court, which is an elective, but not a taxing body. There were 16 independent park commissions with taxing authority. Within the last decade, however, the older system has been replaced to a certain extent by a newer and more efficient government — the commission form. The law making this possible was passed in 1910. It provides that when in cities and villages not exceeding 200,000, electors equal in number to one-tenth of the votes cast for mayor at the last preceding election petition the county judge for the commission form of government it is his duty to submit the proposition at a special election to be called within 60 days, and at this election a majority of the votes cast determines the result. Within five years after its passage, 39 cities and villages, including the capital, adopted the new form; many others have adopted it also within the last two years. The law abolishes the system of ward aldermen and the distinct powers of the mayor and council. The general authority and responsibility for the municipal government is entrusted to a council, consisting of a mayor and four commissioners elected at large. The executive and administrative work in cities under the commission plan is divided among the five departments, each assigned to one of the commissioners. The mayor is in charge of the department of public affairs. The other departments are: Accounts and finances, public health and safety, streets and public improvements and public property. The council elects a city clerk, city attorney, treasurer and other municipal officers as corporation counsel, comptroller, chief of police, chief of fire department and library trustees. In cities of over 20,000 the mayor and commissioners are required to devote at least six hours a day to their official duties.

Revenue.— The general assembly is empowered to provide needed revenue by levying a tax, by valuation, so that every person and corporation pays a tax in proportion to the value of his, her or its property. Certain property, however,— religious, charitable, etc.— may be exempted by general law. The so-called "general property tax," which is the chief support of State and local government, is assessed upon real and personal property at a supposed valuation of one-third of its "fair cash value." In Cook County and the counties not under township organization, the assessment of taxes is largely a county affair; in other places it is entrusted to the town assessors. Assessments are subject to revision by a county board of review and the State board of equalization. The latter consists of 26 members, elected by congressional districts. There is also an ex officio State Tax Levy Board and a Court of Claims. Other sources of revenue for the State are the inheritance tax and a special tax on the Illinois Central Railroad — 7 per cent of the gross earnings. This tax in the first 51 years amounted to $24,400,446.27; for some time it has yielded over a million dollars a year. For municipal governments there are licenses and similar charges. In 1917 Illinois faced an increase of 33 1/3 per cent in the cost of State government for the next two years. The amount asked, $60,000,000, was just twice the amount appropriated six years ago, and $14,000,000 in excess of the appropriations made in 1915. It was cut down somewhat.

Suffrage.— The qualified electors are all male citizens 21 years of age, who have resided in the State a year, in the county 90 days, and in the district 30 days next before the election. Women have the right to vote for all officers in the State, State and local, not created by the constitution, and in national elections for the president. The president is voted for by electors who are chosen as the State legislature may direct. On the other hand, senators and representatives in Congress are chosen by electors qualified to vote for members of the most numerous branch of the State legislature — a constitutionally created State office. Voting is by ballot and persons convicted of infamous crimes are excluded from the right of suffrage.

Militia.— All able-bodied male citizens between the age of 18 and 45 except those exempt by State or national law are subject to military duty and are designated as the Illinois State Militia. This body is divided into the organized and unorganized militia. The first is divided into the Illinois National Guard and the Illinois Naval Reserve. The Illinois National Guard forms the land forces in time of peace according to the statute of 1909, it may consist of not more than 1 major-general, 3 brigadier-generals, 24 battalions of infantry, 1 regiment of cavalry, a corps of engineers, 3 batteries of field artillery, a signal corps, and a field hospital and ambulance corps, with the needed line, staff and non-commissioned officers and the officers of the retired list. The act provides that the infantry be organized into eight regiments, composed of 12 companies with a maximum of 1,154 men, commanded by a colonel. Two or more regiments of infantry commanded by a brigadier-general form a brigade. The statute provided that the staff be organized into the following 10 departments: The adjutant-general's department, the inspector-general's department, the quartermaster's department, the subsistence department, the ordnance department, the medical department, the pay department, the judge-advocate's department, the corps of engineers and the signal corps. This organization was considerably altered by the executive order of the governor which went into effect 1 Jan. 1914. The whole division organization was abolished, the office of major-general was discontinued, the number of brigadier-generals was reduced to two, and the subsistence department was consolidated with the quartermaster's corps. The Illinois Naval Reserve forms the naval force in time of peace. As provided in the statutes, it consists of a ship's complement of 12 divisions, with the necessary line, staff, warrant and petty officers, and the officers of the retired list. It is organized as a ship's crew, commanded by a captain. He is assisted by an executive officer known as the commander, a navigating officer of the rank of lieutenant commander, an ordnance officer and an equipment officer of the rank of lieutenant. The crew is divided into 12 divisions, of which two are steam engineers and one a band. In 1912, 521 officers and 5,586 men were enlisted in the National Guard; in 1916, the figures were 500 and 6,099. In 1912, 50 officers and 587 men were enlisted in the Naval Reserve; in 1916, the figures were 39 and 628. The governor has authority to call out the military forces to suppress mobs, riots or disturbances, and on such occasions commanding officers may make arrests without process.

Politics.— Illinois is divided into 25 congressional districts, but she has 27 representatives in Congress, two being elected at large. The reason for this is that the Illinois legislature did not redistrict the State after the last congressional reapportionment. The electoral vote of the State at successive presidential elections, since its admission in 1818, has been cast as follow, viz.: In 1820, for Monroe; in 1824, one vote for Adams and two for Jackson; in 1823 and 1832, for Jackson; in 1836 and 1840, for Van Buren; in 1844, for Polk; in 1848 for Cass; in 1852, for Pierce; in 1856 for Buchanan; in 1860 and 1864, for Lincoln; in 1868 and 1872, for Grant; in 1876, for Hayes; in 1880, for Garfield; in 1884, for Blaine; in 1888, for Harrison; in 1892, for Cleveland; in 1896 and 1900, for McKinley; in 1904, for Roosevelt; in 1908, for Taft; in 1912, for Wilson; in 1916, for Hughes. During this period the vote of Illinois in the electoral college increased from 3 to 29. Since the Civil War, the Republicans have met with well-nigh uniform success over their old rivals, the Democrats. Other parties, however, have sprung into existence, temporarily at least. In

1872, such men as Governor John M. Palmer, Senator Lyman Trumbull and Gustavus Koerner joined the Liberal Republicans. The National Grange or Patrons of Industry organized in 1869 for the object of uniting all agriculturists for the better securing of their rights as shippers and producers and for the social, moral and educational uplift of their children, entered politics in 1874. Aided by the Democratic Party and dissatisfied elements as the Independent Reform Party and the Democratic Liberal Party they defeated the Republican candidate for superintendent of public instruction and elected many fusion candidates in the smaller divisions of the State. No party secured a majority of the legislature. The Greenback Party in 1876 and other cheap money parties later on developed some strength. The most powerful third party movement, however, occurred in 1912, when Roosevelt as the standard bearer of the Progressives polled 386,478 votes as compared with 405,048 for Wilson, and 253,593 for Taft. In the election of 1916, the vote of the parties was as follows: Republican, 1,152,549; Democratic, 950,229; Socialist, 61,304; Prohibition, 26,047; Socialist Labor, 2,488.

History.— The name of the State is derived from «Illini,» an Indian word meaning «men.» The euphonic termination added by the early French explorers gives the name «Illinois.» In 1659, Pierre Radisson and Medard Chonart des Grossilliers seem to have reached the upper Mississippi, but the real history of Illinois begins with the coming of Marquette and Joliet. In June 1673, they landed upon the east bank of the Mississippi in what is now Illinois. They descended the Mississippi to a point possibly within 400 miles of its mouth. Marquette established a mission at the ancient village of the Kaskaskias. La Salle, Tonti and Hennepin were also early discoverers. The former is credited with building the first fortress in the State, Fort Creve Coeur, in 1679, and with discovering the mouth of the Mississippi River. Here, on 9 April 1682, he took formal possession of «the Louisiana country» in the name of his master, Louis XIV of France. Permanent French settlements were made at Kaskaskia, Cahokia and Fort Chartres about 1720. At first «the Illinois country» was the dependency of Canada but by decree of the Royal Council in 1717 it passed under the government established for Louisiana. A little later, in 1721, it became, by virtue of the same authority, one of the separate provinces into which the Louisiana country was then divided. A commandant and judge were duly appointed, and the seat of authority was transferred to Fort Chartres. Population meanwhile gradually increased in the great American bottom, then embracing the French settlements in Illinois. The French, however, claimed more than they had the ability to hold, and in the long continued struggle with their old rivals, they were decisively defeated on the Heights of Abraham at Quebec, 13 Sept. 1759. By the treaty of Paris, 1763, the Illinois country passed to Great Britain. British domination in the Mississippi Valley, however, was of short duration. While the Revolutionary War was in progress George Rogers Clark at the head of a band of some 200 followers and bearing the commission of Patrick Henry, governor of Virginia, crossed the Ohio River, and landed near Fort Massac. After a perilous six days' march he surprised and captured Kaskaskia, 4 July 1778, and soon the whole Illinois country acknowledged his authority. In the month of October, following the capture of Kaskaskia, the Virginia House of Delegates extended civil jurisdiction over the territory. Courts were established at Cakokia and Kaskaskia, and an election was held for civil officers. John Todd was lieutenant-commandant of the Illinois country from 1778 to 1780. In 1783, the territory passed to the United States by treaty, and a year later Virginia magnanimously ceded her claim to the national government with the understanding that the lands be sold to pay the war debts of the States.

In 1787, the Ordinance for the Government of the Northwest Territory was passed. The commission of Arthur St. Clair, the first governor, bears the date of 1 Feb. 1788, and soon thereafter judges and other officers were appointed, and the new government was duly organized. In 1790, Governor St. Clair paid his first visit to Kaskaskia, the county bearing his name having been established meanwhile. Five years later out of its territory, the county of Randolph was created. The county seats of these two historic counties were Cahokia and Kaskaskia. Pursuant to the provision of the Ordinance of 1787, the Northwest Territory having attained the requisite population, a general assembly was convened in Cincinnati in February 1799, and Illinois was now, for the first time, represented in a legislative chamber. In May 1800 Congress created Indiana Territory, which included the present States of Indiana and Illinois, and the seat of government was established at Vincennes. General William Henry Harrison, later a President of the United States, was the first governor. By judicious treaties with the Indian tribes, he maintained peace and obtained the cession of valuable grants which in time became the homes of white emigrants. The fierce hatred of the Shawnee chief, Tecumseh, for the whites was, in part, the result of these grants. His own tribe allied with the Pottawattomies and the Kickapoos failed to exterminate, as was the intention of Tecumseh, the white settlers, and ended with his own disastrous defeat at Tippecanoe in 1811, by which the power of these tribes was broken. The Fort Dearborn Massacre, 1812, also came about in part because of disputed land claims. From 1806 until 1809 a strong effort was made to organize Illinois as a separate territory. This movement succeeded in February 1809, and the capital was located at Kaskaskia. In 1812, a representative assembly was chosen, a territorial constitution adopted, and a territorial delegate in Congress was elected. Emigration from the older States had set in, and by 1818 the population of the territory was near 40,000. The general assembly in January of that year petitioned Congress for statehood. Nathaniel Pope was then territorial delegate, and through his influence the northern boundary was made 42° 30′ instead of 41° 39′, which seemed likely to prevail before his amendment. The bill, as amended, was passed, and on 3 Dec. 1818, Illinois was duly admitted as a State.

The social history of Illinois is intensely interesting. The first school was taught by Samuel J. Seeley in 1783 at New Design, in what is now Monroe County. The first Methodist church in Illinois was founded in 1793 at Shiloh in the

New Design settlement, and the first camp meeting was probably held near the same place in 1807. The first Baptist church in Illinois was also organized at New Design by David Badgley in 1796. One of the first Presbyterian churches was organized at Turkey Hill, a settlement four miles southeast of Belleville, 20 April 1820. Early missionaries and traveling ministers seemed disgusted with the religion and morals of early Illinois settlers, but the latter, it must be remembered, were typical frontiersmen. A Mr. Low, who was in Shawneetown in January 1818, describes conditions as follows: «Among its two or three hundred inhabitants there was not a single soul that made any pretentions to religion. Their shocking profaneness was enough to make one afraid to walk the street; and those who on the Sabbath were not fighting and drinking at the taverns and grog shops were either hunting in the woods or trading behind their counters. A small audience gathered to hear the missionary preach. But even a laborer who could devote his whole time to the field might almost as soon expect to hear the stones cry out as to expect a revolution in the morals of the place.» Thomas Lippincott, for some time editor of the *Edwardsville Spectator* and later one of the trustees of Illinois College, said of Shawneetown in 1818: «We found a village not very prepossessing; the houses, with one exception being set up on posts several feet from the earth. The periodical overflow of the river accounts for this.» The first newspaper of the State was the *Illinois Herald* started at Kaskaskia, 6 Sept 1814, by Matthew Duncan. In 1819, times were hard, prices were low and money was extremely scarce. A cow and a calf would not bring over $5.00; wheat was 35 cents a bushel, and corn was as low as 10 cents. The following prices prevailed at Albion in 1819: a fine turkey, 25 cents; chickens, 12 cents; beef, 5 cents per pound; eggs, 12½ cents per dozen; cheese, 30 cents per pound; butter, 16 cents; bacon, 15 cents; flour, $9.00 per barrel; deer (whole carcass including the skin), $1.50; melons, 12½ cents; honey, $1.00 per gallon; whisky, $1.00 per gallon; fine Hyson tea, $2.00 per pound; moist sugar, 31 cents; coffee, 62 cents; fish, 3 cents. During the first decade which followed the organization of the State, the habits of the people, in the main, were simple and their wants few. Barter in a large measure supplied the place of a medium of exchange. Commerce, in so far as it had any existence with the outer world, was by wagons across the Alleghanies, and by flatboats down the Ohio and the Mississippi. The log cabin furnished protection to the pioneer from the winter's storm. With rude implements of his own construction, he cultivated his fields, and with his rifle defended his loved ones from the incursions of the savage. At the time of its admission, there were only 23 post-offices within the limits of the entire State. At the period indicated and for years afterwards, the frontiersman regarded himself as especially favored if located within a dozen miles of a post-office. The mails reached the settlements weekly or monthly upon horseback or by stage coach. The log cabin with its puncheon floor supplied the double purpose of temple of learning, and place for public worship. Articles of apparel, were, with rare exception, of home manufacture. Railroads, colleges and universities were unknown. The first seminary in the State was organized at Rock Springs, 1 Jan. 1827 by John Mason Peck; it is now known as Shurtleff College and is located at Alton. Less than 10,000 persons were engaged in agricultural pursuits. Chicago had scarcely a place upon the map. Population drifted northward, however; in 1819 Vandalia had been made the capital, but in 1836 it was changed to Springfield. From 1818 to 1860, the most interesting internal questions were those relating to slavery, banking and internal improvements. Northern Illinois had been largely settled by people from the free States; southern Illinois, by people from the slave States. In 1823 the legislature, by the necessary two-thirds vote, submitted to the people the question of calling a convention to revise the constitution. This was undoubtedly with the object of introducing slavery. For 18 months the most intense excitement prevailed. Political leaders and newspapers were divided. Governor Coles, a Virginian and a former slave holder, Thomas Birkbeck, a gifted English writer, J. M. Peck, an influential Baptist minister, and Daniel P. Cook, an eloquent speaker, opposed the convention. Jesse B. Thomas, Richard M. Young, John McLean, E. K. Kane, John Reynolds, Thomas Reynolds and Ex-Governor Bond took the stump for the convention. The *Edwardsville Spectator*, the *Illinois Intelligencer* at Vandalia, and the *Illinois Gazette* at Shawneetown opposed the convention; the other two papers, the *Republican Advocate* at Kaskaskia and *The Republican* at Edwardsville favored it. The election on 2 Aug. 1824 resulted in the defeat of the convention by a vote of 6,640 to 4,972. The total vote cast was 11,612 as compared to 4,671 for presidential electors in November of that year. Eleven counties out of 30 favored the convention. They were Alexander, Pope, Jackson, Franklin, Gallatin, Hamilton, White, Jefferson, Wayne and Fayette. Johnson was a tie. Union was against the convention by 27 votes. All these countries, except Fayette, were in what was then regarded as the South. Slavery sentiment still persisted, however, and on 7 Nov. 1837, Elijah P. Lovejoy was murdered by a pro-slavery mob at Alton for trying to publish an anti-slavery paper. After this, sentiment seemed to change, and in 1842 the Liberty Party was organized; in 1848, it united with the Free Soil Party. The Republican Party was definitely organized in 1856. Immigration from the northern States had outweighed that from the southern States. As early as 1816 the territorial legislature had passed a law chartering banks at Shawneetown, Kaskaskia and Edwardsville. The charter incorporating the State Bank of Illinois was passed in 1821, and was to continue 10 years. The capital was $500,000. The parent bank was to be located at Vandalia, and the branch banks at Edwardsville, Brownsville, Shawneetown and Albion. State bank bills were issued to the amount of $500,000, but they soon depreciated to 30 cents on the dollar. The State had lost at least $100,000 in this banking business, but after the expiration of the charter, in spite of bitter opposition, another State bank with a capital of $1,500,000 was created. The principal bank was located at Springfield with a branch at Vandalia. The Shawneetown bank was revived with a capital of $300,000.

In 1842, however, both the State Bank at Springfield and the Bank of Illinois at Shawneetown became bankrupt. The following year both were forced into liquidation, and the former was given four years to wind up its affairs. The «Free Banking Law» modeled after the New York Plan of 1838 was not passed until 1851. The State, however, lost heavily in other enterprises besides banking. In 1840 the people woke from their dreams to find that the State was $14,000,000 in debt, its bonds worth only 14 cents on the dollar, and with nothing to show for it except a 25-mile railroad from Springfield to Meredosia. This was sold afterwards for $100,000 in State bonds. The question of repudiation was agitated, but Governor Ford's decided stand in favor of payment without defalcation or discount saved the credit of the State. A large part of this indebtedness was due to unwise internal improvements. In 1837 alone, a bill appropriating $10,200,000 was carried over the veto of the governor and the council of revision. This sum, with the exception of $400,000 for improving the Wabash, Illinois, Rock, Kaskaskia and Little Wabash rivers and the Western Mail Route, and $200,000 to pacify disappointed counties, was allotted for various railroads. It increased the debt from $271,276 to $6,668,784. The most important result of early internal improvements is the Illinois-Michigan Canal which was completed in 1848, after some 12 years of spasmodic work at a cost to the State of over $5,000,000. The Illinois Central Railroad was given its charter in 1851, and the road was completed in 1856. The total cost according to Mr. Ackerman, president in 1883 when the statement was made, was $40,000,000. Illinois has seen her share and borne her part in war. As the result of the Black Hawk War of 1831–32, Indian depredations ceased, and the remnants of the once powerful tribes disappeared forever from the State. What is known in local history as «the Mormon War» occurred in Hancock County on the Mississippi River. Nauvoo was the seat of Mormon authority and the site of a splendid temple. In 1844, Joseph Smith, the Mormon leader, was assassinated by a mob, and soon thereafter his followers left the State. Illinois furnished six regiments and some independent companies during the Mexican War and 255,092 soldiers to the Federal army during the Civil War. Strong opposition to the Federal policy, however, developed in 1863 and 1864. The Knights of the Golden Circle, a secret organization, sympathized with the South. One of the ways in which they showed thir discontent was by trying to dissuade soldiers home on furlough from returning to their regiments at the end of their leave of absence. In the elections of 1864, nevertheless, the Republicans and Union Demcrats united, and after an exciting campaign carried the day. In the Spanish-American War Illinois furnished nine regiments of infantry, one of cavalry and one battery of light artillery. In August 1917 the State was about 5,000 men ahead of her quota for the World War. Since 1865 the only additional questions that can be considered are those relating to labor and capital and improved highways. With the increasing importance of industry, so well revealed by the World's Columbian Exposition held at Chicago in 1893, and with stronger organizations the relations between labor and capital have become more important. There are no authentic records for the beginning and growth of the Illinois State Federation of Labor prior to its seventh annual convention which was held in Jacksonville 14 Jan. 1890, but at that time there were 11 delegates who represented approximately 35,302 union men. At the convention held at Alton, 18 Oct. 1915, there were 596 delegates who represented 750,000 organized workers. Strikes have been common, and riots all too frequent. On 4 May 1886 a mob collected on Haymarket Square, Chicago, and when the police approached seven of the latter were killed by the explosion of a bomb. Eight men, termed anarchists, were tried for the crime; four were hanged, three were sent to the penitentiary and the other committed suicide. In 1894 the American Railway Union went out on a strike at Chicago. President Cleveland ordered Federal troops to the scene in order to preserve order and protect the mail. On 14 Aug. 1908 a race riot broke out in Springfield and for nearly two days lawlessness triumphed. Four regiments of militia were needed to restore order. Seven people were killed, more than 50 were wounded and property valued at over $100,000 was destroyed. Early in July 1917 an even more disastrous and disgraceful race riot occurred at East Saint Louis, due largely to the industrial and social discontent aroused by the rapid influx of negro workers. The roads of Illinois deserve mention. The Tice Road Laws, 1913 and 1915, established system in the matter of improving highways. The law provides that about 18 per cent of all public roads of the State shall be «State Aid Roads.» These are to be constructed or improved by funds furnished by the State and the counties in equal amounts. Under this arrangement, when improved, the State undertakes to maintain them forever at its expense, provided they are constructed of as good a type as concrete or brick. If the construction is of gravel or macadam the county shares equally with the State in the cost of maintenance; if the road is of earth, the cost of maintenance is borne wholly by the counties. The type of road to be constructed is left to the county boards provided they can agree; if they cannot determine the matter, the State Highway Commission may select the kind. These roads reach into every community of the State. Thirty per cent of the citizens reside along the system of State aid roads and 75 per cent of the people live along or within a mile of these thoroughfares. Not a home in the State will be further than four and a half miles from these State aid roads. The following funds made available by equal appropriations from the Federal government and the State have been definitely allotted by the Department of Public Works and Buildings, acting in conjunction with the board of highway advisers: (1) $1,413,000 to the National Old Trails road beginning at the Indiana State line and connecting Marshall, Greenup, Effingham, Vandalia, Greenville, Collins and East Saint Louis; (2) $1,020,000 to the Lincoln highway connecting Chicago, Wheaton, Geneva, De Kalb, Rochelle, Dixon, Sterling, Morrison and Fulton; (3) $2,215,000 to the Chicago-Springfield road connecting Chicago, Joliet, Morris, Ottawa, LaSalle, Peoria, Mason City and Springfield; (4) $958,000 to the Springfield-East Saint Louis road connecting Springfield, Carlinville, Staunton, Edwardsville and East Saint Louis; (5) $114,000 to the Dixie highway connecting Chicago, Chicago Heights, Mommence, Watseka and Danville; (6) $400,000 to the road from Chicago to the Wisconsin line connecting Chicago, Waukegan and Zion City. These allotments cover the amount to be received up to and including 1 July 1920, available as follows: $1,326,000, 1 July 1917; $1,326,000, 1 July 1918; $1,765,000, 1 July 1919, and $2,209,000, 1 July 1920.

The governors of Illinois have been:

TERRITORIAL

Ninian Edwards		1809–18

STATE

Shadrach Bond	Democrat	1818–22
Edward Coles	"	1822–26
Ninian Edwards	"	1826–30
John Reynolds	"	1830–34
William L. D. Ewing	"	1834
Joseph Duncan	"	1834–38
Thomas Carlin	"	1838–42
Thomas Ford	"	1842–46
Augustus C. French	"	1846–53
Joel A. Matteson	"	1853–57
William H. Bissell	Republican	1857–60
John Wood	"	1860–61
Richard Yates	"	1861–65
Richard J. Oglesby	"	1865–69
John M. Palmer	"	1869–73
Richard J. Oglesby	"	1873
John L. Beveridge	"	1873–77
Shelby M. Cullom	"	1877–83
John M. Hamilton	"	1883–85
Richard J. Oglesby	"	1885–89
Joseph W. Fifer	"	1889–93
John Peter Altgeld	Democrat	1893–97
John Riley Tanner	Republican	1897–1901
Richard Yates	"	1901–05
Charles S. Deneen	"	1905–13
Edward F. Dunne	Democrat	1913–17
Frank O. Lowden	Republican	1917

In 1918 the centennial anniversary of the entry of Illinois into the Union as the twenty-first State admitted was commemorated by special celebrations under the direction of the Illinois Centennial Commission.

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ILLINOIS, University of, the State University, situated at Urbana. It was founded in acceptance of the national land grant of 1862 (see Colleges, Land Grant) and was incorporated in 1867 as the Illinois Industrial University. It was opened 2 March 1868, with a faculty of three and about 50 students. In 1870 women were admitted; in 1877 the State legislature granted power to confer degrees; and in 1885 the name was changed to the University of Illinois. It was the first American university to give shop instruction, a mechanical shop being equipped in 1870. It is governed by a board of trustees, consisting of three ex officio members, including the governor, and nine elective members. The undergraduate department includes the college of liberal arts and sciences, of engineering and of agriculture; corresponding graduate courses are given; other departments of the university are the State library school, the school of music, the college of law, the college of medicine, the college of dentistry and the school of pharmacy, the three latter being situated in Chicago. The university has a number of valuable scientific collections; the agricultural experiment station, organized under the Federal law of 1887, is controlled by the university trustees, and is supported by State and national appropriation; the general university library numbers 325,000 volumes besides pamphlets; other libraries under university control are the library of State Laboratory of Natural History (8,000 volumes and 39,266 pamphlets), the library of the college of law and special collections in connection with the professional schools. The annual income amounts to $2,500,000, mostly from a one-mill tax; the number of students in all departments was 6,150 on 1 Nov. 1915, the number of faculty and administrative officers, 780.

ILLINOIS CENTRAL RAILROAD. The history of the Illinois Central Railroad embraces many interesting episodes, some of which bore directly in their effect on the building up of the nation, of the State of Illinois and of the city of Chicago. Prior to the incorporation of this line, the State of Illinois had vainly endeavored to establish an effective and profitable central railroad. In doing this, a large State debt accumulated and the outlook for wiping out that debt was not at all promising when the act to incorporate the Illinois Central Railroad Company was approved by Governor French on 10 Feb. 1851. As events have proved, this act produced results more momentous in the history of the State and of the United States than any act approved by an Illinois executive before or since.

The inception of this important enterprise dates back to 1835, when two of the State's most famous men, Hon. Sidney Breese and Hon. Stephen A. Douglas, first discussed publicly the advisability of penetrating the centre of the State by means of a railroad and thus opening up a vast territory which at that time was an uninhabited and partially unexplored wilderness. On 16 Jan. 1836, the State legislature passed an act incorporating «The Illinois Central Railroad Company.» Two years later an attempt was made to start this road, which was intended to run 457 miles. The sum of $3,500,000 was appropriated for the route, but within a few months the difficulties surrounding the situation in the matter of actual track-laying became so great that, after an expenditure of $506,000, principally on surveys and preliminary work, the plan was abandoned.

In 1843 a private corporation entitled "The Great Western Railroad" secured a charter and began work, but soon became discouraged and surrendered their charter. In 1849 this charter was renewed, only to be again surrendered to make room for the road now operating and known as The Illinois Central Railroad. At the time the road was commenced by the present corporation it was estimated that the aggregate cost would be about $15,000,000. The actual cost for construction, including all extension up to the present time, has been nearly $50,000,000.

Original Charter Directors.— The 12 directors selected in 1851, under the charter and known as the "Charter Directors," included nine prominent New York men and three well-known citizens of Boston. The directors from New York were Robert Schuyler, George Griswold, Gouverneur Morris, Jonathan Sturges, Thomas W. Ludlow, John F. A. Sanford, Henry Grinnell, Joseph W. Alsop and Leroy M. Wiley. Those from Boston were Franklin Haven, Robert Rantoul, Jr., and David A. Neal.

Population.— In 1850, shortly before the chartering of the railroad, Illinois stood 11th in population and 17th in wealth among the States. The marked difference during the following 10 years is worthy of note as showing the direct effect of improved and extended railroad accommodation. In 1860 Illinois stood fourth in population among the States, also fourth in wealth.

Railroad Conditions in 1851.— In 1851, when the charter of the present road was granted, the population of Chicago was 30,000. That city had no railroad connection with the East nor in any other direction. In the same year the Hudson River Railroad, 140 miles, from New York to East Albany, was opened. Other events of importance during 1851 were the extension of the Baltimore and Ohio Railroad to Cumberland and the opening of an Erie Railroad line from Pierpont on the Hudson of Dunkirk on Lake Erie. Wisconsin had 20 miles of railroad at that time. The railroad mileage of Indiana was 228 miles, and of Kentucky 78 miles. Just prior to the chartering of the Illinois Central there were 111 miles of railroad track in the State. When the 50th anniversary of the road was held at Chicago in 1901 it was announced that the company was then operating railroads in 13 States.

Development.— The first section of the road, covering 705.50 miles, and running from Chicago to Cairo and from Centralia to Dubuque, was opened on 27 Sept. 1856, being about five and one-half years after the issuing of the charter. Since the opening of this main line other lines have been purchased, including part of the Saint Louis, Peoria and Northern railroads from Springfield to East Saint Louis, Illinois, in 1900. This purchase was followed by a number of other purchases and absorptions.

Roads Acquired by Purchase, etc.— From Springfield to East Saint Louis, Ill. (part of the Saint Louis, Peoria and Northern); Peoria, Decatur and Evansville, extending from Pekin, Ill., to Evansville, Ind., with a branch to New Harmony, Ind.; Chicago, Madison and Northern; Kankakee and Southwestern; Chicago and Springfield; Saint Louis, Alton and Terre Haute; Chicago, Havana and Western; Mound City; Chicago and Texas; Riverside and Harlem; the parts of the Rantoul and Illinois and Indiana railroads lying in the State of Indiana, extending from West Lebanon to State line and from Switz City to State line.

Leased Lines.— The leased lines of the Illinois Central Railroad are Kensington and Eastern: South Chicago; Blue Island; Peoria and Pekin Union; Dubuque and Sioux City; Chicago, Saint Louis and New Orleans and the Canton, Aberdeen and Nashville railroads.

Mileage. (See Annual Report, p. 15).— The corporation now controls one of the most important groupings of railroad lines in the United States. The total mileage operated, according to the latest official report available, is 4,766.93 exclusive of the Yazoo and Mississippi Valley Railroad (1,371.98 miles). The length of the main line, from Chicago to Cairo, Ill., is given as 364.73 miles; Omaha Division, from Chicago to Council Bluffs, Ia., 513.96 miles; New Orleans Division, from Cairo to New Orleans, La., 547.79; Louisville Division, from Memphis, Tenn., to Louisville, Ky., 398.12 miles; other lines owned or leased operated in the system, 2,549.12.

Additional Tracks. (See Annual Report, p. 15).— The length of line having two tracks is 799.62 miles; third and other additional main tracks, 194.49 miles; sidings, etc., 2,129.65. The gauge of this system is 4 feet 8½ inches. The average weight of steel rails is 72.78 pounds.

Charter Tax.— The charter of the company, reserved to the State of Illinois, calls for payment, in lieu of taxes, of 7 per cent of the gross receipts of the 705.50 miles of road originally built under that charter. The total amount paid to the State of Illinois under the provisions of this charter, from the opening of the road in 1855 to 30 June 1916, was about $34,000,000.

Dividends.—Between the beginning of operations in 1851 and 30 June 1916, the stockholders received about $189,000,000 as dividends out of the earnings of the company.

Rolling Stock.— The rolling stock of the company, 30 June 1916, included 1,419 locomotives, 521 passenger and chair cars, 32 café dining cars, 165 baggage, mail and express cars, 43 postal cars (3 of these partly owned), and 61,048 freight cars, making a total, with minor items under this head, of 62,347 cars.

Earnings.— The earnings of the road, for the year ending 30 June 1916 amounted to $69,077,342.56, or $14,490.37 per mile. These earnings were divided as follows: Passenger traffic, $16,836,511.03; freight traffic $46,457,388.45; miscellaneous earnings, $5,783,493.08.

Net Earnings, Receipts and Dividends.— The net earnings of the road for the year ending 30 June 1916 were $17,903,614.82.

Expenses.— Operating expenses of the road for the year ending 30 June 1916 amounted to $51,173,727.74, or $10,734.73 per mile. The amount paid for taxes (1915–16) was $3,724,020.73.

Bonded Debt.— The bonded debt of the road, including about 30 investments, aggregates $280,239,000. Of this total the last issue that matured was $88,000, issued in 1880 and maturing in 1910. An issue of $2,800,000, placed in 1869, matured in 1917. The next, following in order, is an issue of $968,000 made in 1881 and maturing in 1921; an issue of $470,000 made in 1883 and maturing in 1923; an issue of $538,000, made in 1886 and maturing in 1931; an issue of $241,000, made in 1887 and due in 1932; an issue of $34,500,000, issued in 1895–1905, and due in 1951; and $25,000,000 issued in 1892, and due in 1953.

Opening up of the State.— The beginning of active operations in establishing the line marked the beginning of State development throughout a vast area which, up to that time, had been inaccessible to traffic of any kind except by means of the most rural contrivances, utterly inadequate for any but the most restricted local demands. The new move toward opening up commercial possibilities immediately doubled the price of public lands. These tracts were readily bought up as conditions improved and steadily increased in value year by year.

At a critical juncture in the nation's history, when it became necessary to move regiments, brigades and divisions of western troops to the scene of active Civil War operations, the Illinois Central Railroad provided the only available means of adequate rapid transportation. At the same time, the existence of that railroad and its excellent management made the prompt supply of rations and forage possible.

Payment of State Debt.— As mentioned in a previous paragraph, the attempt of the State to operate successfully a central railroad ended in utter failure. In 1851 the people of Illinois were under a burden of some $60,000,000 as the outcome of the experiment. The establishment and active operation, with ever continuing development of the road, enabled the whole of that debt to be paid off in due course with proper interest.

Other Benefits to State and City.— The persistency of the railroad authorities in extending their own lines and giving added vitality to smaller railroads made possible the cultivation of the Grand Prairie, previously waste, thereby raising the prestige of the State as a productive national factor of extraordinary importance. It is on record that over $3,000,000 has been expended since about 1836 by the railroad company upon the construction of dikes, piers and breakwaters to protect the city against lake encroachments. Very great benefits, too, have been derived by Chicago from being brought into close commercial touch with prairie lands and the agricultural area of the Lower Mississippi Valley. Chicago has also gained an outlet by rail to the Gulf of Mexico. It is said, to the credit of the Illinois Central Company, that the extent and vigorous administration of its affairs during the period extending from the inception of the World's Fair in 1893 until its close made the success of that enterprise possible by furnishing ample transportation within its jurisdiction for the immense passenger and freight traffic which impended there from start to finish.

Statistical.— The States in which the Illinois Central Railroad is now operating are Illinois, Indiana, Wisconsin, Iowa, Nebraska, Minnesota, South Dakota, Kentucky, Tennessee, Mississippi, Louisiana, Missouri and Alabama. The present total mileage of the road, including leased lines and the Yazoo and Mississippi Valley Railroad, is nearly one-half the railway mileage of the State. The total number of stockholders in the company, according to the latest report of the Interstate Commerce Commission, is 10,697. The par value of stock outstanding since 1908 was $109,296,000. The highest rate at which stock was quoted in 1904 was 159; lowest 125¾. The highest rate quoted for 1905 was 183; lowest 152¾ at end of 1910, around 135.

Other lines operating in Illinois are the Santa Fé; Baltimore and Ohio; Chicago and Alton; Chicago and Northwestern; Chicago, Burlington and Quincy; Chicago Great Western; Chicago, Indianapolis and Louisville; Chicago, Milwaukee and Saint Paul; Chicago, Rock Island and Pacific; Cleveland, Cincinnati, Chicago and Saint Louis; Erie; "Frisco System"; Grand Trunk; Great Central Route; Iowa Central; Lake Erie and Western; Lake Shore and Michigan Southern; Louisville and Nashville; Michigan Central; Missouri Pacific; Mobile and Ohio; New York, Chicago and Saint Louis; Pennsylvania; Southern; Toledo, Saint Louis and Western; Vandalia; Wabash and Wisconsin Central.

ILLINOIS COLLEGE, an institution located in Jacksonville, Ill., the oldest college in the State, founded in 1829, largely through the efforts of the "Yale Band," an eastern organization of seven college men. The first president was Edward Beecher, brother of Henry Ward Beecher. In 1916 the total attendance was 370 students with 25 instructors. The endowment in that year was about $389,000; total value of endowment and plant being about $707,000. The institution is coeducational and includes in addition to the college department, a conservatory of music, and the preparatory department, Whipple Academy. The college library contains about 19,000 volumes.

ILLINOIS INDIANS (*Iliniwek*, men), a confederacy of Algonquian tribes, formerly occupying southern Wisconsin, northern Illinois and sections of Iowa and Missouri. It comprised the Cahokia, Kaskaskia, Michigamea, Moingwena, Peoria and Tamaroa. Early explorers differ greatly in their estimates of the number of the confederation. They were almost continually at war with the Sioux, Foxes and other northern tribes. A struggle with the Iroquois about 1675 greatly weakened them and liquor obtained from the French well-nigh destroyed their morale. By 1750 they numbered about 2,000, which was greatly reduced in the war of extermination by the Lake tribes in revenge for the murder of Pontiac. In 1778 the Kaskaskia still numbered over 200 souls, while the Peoria and Michigamea together numbered 170. In 1800 there were only 150 left. In 1883 the survivors represented by the Kaskaskia and Peoria, sold their lands in Illinois and removed west of the Mississippi, and are now in the northeast corner of Oklahoma, consolidated with the Wea and Piankashaw. In 1905 their number was 195. The Illinois were tall and robust, with pleasant visages. They appear to have been timid, easily driven from their homes by their enemies, fickle and treacherous. They were excellent archers, and used also in war a kind of lance and a wooden club. Polygamy was practised and unfaithfulness in a wife was punished by cutting off the nose of the offender. It was not the custom of the Illinois, at the time the whites first became acquainted with them, to bury their dead. The body was wrapped in skins and attached by the feet and head to trees. It is supposed, however, that the skeletons were later placed in the earth. Prisoners of war were usually sold to other tribes. The huts of the northern tribes were made like long arbors and covered with double mats of flat flags or rushes sewed tightly together. There were four or five fires to each cabin and two families to each fire. The towns were not inclosed. Cahokia, Kaskaskia, Matchinkoa, Moingwena and Peoria are among the villages of these tribes which were known to the white pioneers. Consult 'Handbook of American Indians' (Vol. I, pp. 597–599, Washington 1907).

ILLINOIS AND MICHIGAN CANAL. See CANALS.

ILLINOIS RIVER, the principal affluent of the Mississippi, formed by the confluence of the Kankakee, Des Plaines and Du Page rivers, in Grundy County, about 40 miles southwest of Chicago. Its entire course of nearly 500 miles is within the State, through a fertile, undulating country, rich in bituminous coal deposits. It flows first westward to Ottawa and La Salle, at Depue bending southwestward past Lacon, Chillicothe, Peoria, Pekin, Havana and Beardstown, and near Naples turning due south and joining the Mississippi about 18 miles above Alton, at the mouth of the Missouri. The river is 1,200 feet wide at its mouth and is navigable throughout to La Salle where a ship canal about 120 miles long connects it with Lake Michigan at Chicago, thus ensuring a clear waterway from the Great Lakes to the Mississippi and the Missouri. The Illinois has numerous tributaries of which the Fox and Sangamon rivers are the chief.

ILLINOIS STATE NORMAL UNIVERSITY, located at Normal, a suburb of Bloomington, Ill., was founded in 1857. It is the oldest State normal school in the Mississippi Valley, and has furnished principals or instructors for nearly all of the younger normal schools in the central and western States. Up till 1916 it had given instruction to 27,576 normal students, nearly all of whom have become teachers. Its graduates number 2,616. The school occupies five buildings upon a beautiful campus of five acres. It is well equipped with a library, laboratories, gymnasium and apparatus for instruction in all the various branches of study. Its revenue, about $230,000 per year, appropriated from the State treasury, includes the interest derived from the college and seminary funds, granted by the Federal government in 1818. It is governed by the Board of Education of the State of Illinois, a body of 15 appointed by the governor. The State superintendent of public instruction is ex officio secretary of the board. Its sole purpose is to prepare teachers for the schools of the State; accordingly students are required to sign a pledge declaring their intention to teach. Tuition is free. The organization includes the teachers' college with a full four-year course to prepare high-school teachers, principals and superintendents; the normal school to educate teachers for the elementary and rural schools; the university high school and the elementary training school. The two latter serve for the practical training of student teachers. The scope of its work includes the preparation of every kind of teacher needed in the public schools. The required work includes courses in pedagagy, psychology and general method, history and philosophy of education, school management and the Illinois school system and one year of practical teaching in the training department. Along with these are provided courses in special method in the various branches of the elementary and high-school course. Special courses are provided in manual training, art, vocal music, the household arts, commercial branches and agriculture. The attendance in 1916 was 2,806, besides 630 in the training department. The regular faculty of instruction numbers 61; 40 additional teachers are employed in the summer school. The presidents of the institution have been Gen. Charles E. Hovey (1857–61); Richard Edwards (1862–76); Edwin C. Hewitt (1876–90); John W. Cook (1890–99); Arnold Tompkins (1899–1900); David Felmley (1900–).

ILLINOIS WESLEYAN UNIVERSITY, founded in 1850 under the auspices of the Methodist Episcopal Church, at Bloomington, Ill. The college courses provide for the degrees of B.A., B.S., LL.B. It has, also, a preparatory school and a law school. The number of students is 640, professors 40, volumes in library, 12,000.

ILLITERACY, inability to read or write, or both. The basis of estimation is either a general census of the population over a certain age, the percentage of those unable to sign their marriage certificates, or the records of army recruits. The following table gives the percentage of illiteracy in the several nations among those over a certain age, varying from 5 to 12. The dates are generally in the neighborhood of 1910.

COUNTRY	Year	Per cent illiterates
Austria	1910	18.7
Belgium	1910	12.7
Bulgaria	1905	65.5
England and Wales	C. 1910	5.8
France	1906	14.1
Germany	C. 1900	0.11
Greece	1907	57.2
Hungary	1910	33.3
Ireland	1911	9.2
Italy	1911	37.0
Malta	1901	57.5
Netherlands	C. 1900	4.0
Portugal	1911	68.9
Roumania	1909	60.6
Russia	1897	69.0
Scotland	C. 1900	3.57
Serbia	1900	78.9
Spain	1900	58.7
Switzerland	C. 1900	0.3
United States	1910	7.7
Native white, native parents, U. S	1910	3.7
Native white, foreign parents, U. S	1910	1.1
Foreign-born white	1910	12.7
Negro, U. S	1910	30.4
Argentina	1895	54.4
Brazil	1890	85.2
Canada	1911	11.0
Chile	1907	49.9
Cuba	1907	43.4
Mexico	1910	70.7
Australian	1911	1.8
India	1911	92.1
Philippine Islands	1903	55.5
Union of South Africa	1911	69.7

Illiteracy in the United States is taken on the word of the people being investigated among those 10 years old or over at the decennial census. The figures for 1910 are:

STATES	Per cent
United States	7.7
New England	5.3
Maine	4.1
New Hampshire	4.6
Vermont	3.7
Massachusetts	5.2
Rhode Island	7.7
Connecticut	6.0
Middle Atlantic	5.7
New York	5.5
New Jersey	5.6
Pennsylvania	5.9
East North Central	3.4
Ohio	3.2
Indiana	3.1
Illinois	3.7
Michigan	3.3
Wisconsin	3.2
West North Central	2.9
Minnesota	3.0
Iowa	1.7
Missouri	4.3
North Dakota	3.1
South Dakota	2.9
Nebraska	1.9
Kansas	2.2
South Atlantic	16.0
Delaware	8.1
Maryland	7.2
Dist. of Columbia	4.9
South Atlantic — *Cont'd*	
Virginia	15.2
West Virginia	8.3
North Carolina	18.5
South Carolina	25.7
Georgia	20.7
Florida	13.8
East South Central	17.4
Kentucky	12.1
Tenessee	13.6
Alabama	22.9
Mississippi	22.4
West South Central	13.2
Arkansas	12.6
Louisiana	29.0
Oklahoma	5.6
Texas	9.9
Mountain	6.9
Montana	4.8
Idaho	2.2
Wyoming	3.3
Colorado	3.7
New Mexico	20.2
Arizona	20.9
Utah	2.5
Nevada	6.7
Pacific	3.0
Washington	2.0
Oregon	1.9
California	3.7

Consult the various censuses of the United States, the Annual Reports of the Commissioner of Education, and Bulletin No. 20 of the United States Bureau of Education, entitled ‘Illiteracy in the United States’ (Washington 1913).

ILLUMINATED MANUSCRIPTS. See MANUSCRIPTS, ILLUMINATED.

ILLUMINATI, ĭ-lū-mĭ-nä'tī («the illuminated»), a name taken by or given to various groups of individuals existing during the past 2,000 years, who believed in and taught a doctrine of illumination or inner light. The fundamental idea of their faith was that living a life of purity and service would open the inner senses, so that they would obtain spiritual sight or clairvoyance, becoming seers, etc., able to see and converse with the angels, discarnate intelligences or beings of higher planes. Many have thought that these associations, which are hinted at as existing at various periods since the time of Christ, were survivals of the Eleusinian mysteries (q.v.). They had many ideas in common with the Hermetic and other old philosophies, but were specially characterized by a conviction that it was possible to do the things later recorded of Joan D'Arc and of Emmanuel Swedenborg, both of whom believed that they were in regular communication with and directed by intelligences from the heaven world. In 1490 a reference is found of them under the title of Aluminados. In 1511 the Spanish Inquisition (consult ‘Los Heterodoxes Espanoles,’ Vol. V, 1881), considered a case of a woman of this order, who claimed to hold conversations with the Virgin Mary. She escaped, but at later dates the Inquisition severely prosecuted many who held such doctrines. Among them were the Guerists, who flourished mainly in France in the 17th century. The Illuminati were closely related to the Rosicrucians (q.v.), of which a modern organization exists. There are many Freemasons who believe that their own organization was founded on an earlier body, perhaps more or less identical with the Illuminati, as many of the teachings are similar. The Perfectibilists of Germany and the Martinists of France were also sometimes known as Illuminati, from their teachings. Adam Weishaupt has written several German works that discuss the progress and beliefs of the Illuminati. Compare MYSTICISM. Consult Tschackert, ‘Hauck's Realencycklopädie’ (1901).

ILLUMINATING GAS. See GAS ILLUMINATION.

ILLUMINATING GAS ENGINE. See INTERNAL COMBUSTION ENGINE.

ILLUMINATION. See GAS ILLUMINATION; ELECTRIC LIGHTING; STREET LIGHTING; LAMPS.

ILLUSION, in psychology and in epistemology, a perception which fails to reveal the true character of an object perceived. The word illusion is used in three different ways: (a) The mental construction, on the basis of data which are real in their own proper sphere, of a psychal object, which an illuded person accepts as real, but which is unreal or fantastic; (b) a mental object thus constructed; (c) the general mental acceptance and substitution of what is unreal for real.

In short, an illusion is an error. An error is nothing more than a psychological condition of blindness to the truth. By truth may be understood an inner assimilation of reality. The number of errors is unlimited, truth alone is one. When in psychological literature the word illusion occurs, it conveys one of the two ideas which receive definition respectively in definitions *a* and *b;* the notion conveyed in above occurs less frequently. Illusion is thus any mistaken mental construction which has reliable data as its point of departure. It always means a misinterpretation of the significance of a particular sensory impression. A sensory impression is the effect of an event upon a sentient being. But illusions occur in connection with not only the senses of taste, smell, touch, hearing and seeing, but also with certain other and more obscure modes of consciousness. In truth it must be said that the senses represent reality neither wrongly nor rightly. All that science can say about the sense-organs in this connection is that under different circumstances they produce different sensations and perceptions. So that the term sense-illusion is a very misleading expression. The circumstances which condition sensation are extremely various in character. They are partly external, being inherent in the objects, partly internal, being inherent in the sensory organs, and partly interior, being confined in their activity within the central organs; and therefore, it can sometimes appear, when notice is taken of only the external circumstances, as if an organ acted differently under identical conditions. Thus it became customary to call the unusual effects sense-deceptions or sense-illusions. Consult Ernst Mach, ‘Über die Abhavgigkeit der Netzhautstellen von einander’ (in the ‘Vierteljahrsscrift für Psychiatrie,’ Leipzig and Neuwied 1868). Indeed there are no such things as illusions of sense at all. Objects of sense experience, even when they occur in dreams, are the most indubitably real objects known. The truth is, that that which makes us call such objects unreal in dreams is merely the unusual connection in which they stand with other objects of sense. Objects of sense are called real when they have the relation with other objects of sense which experience has led us to regard as normal. Failing this, we call them illusions. But what is deceptive or illusory is only the inferences to which they give rise. In themselves, they are every bit as real as the experienced objects of waking life. And conversely, sensible objects of waking life must not be assumed to have any more intrinsic reality than sensible objects of dreams. It is only by some reality not merely sensible that dreams can be condemned. Illusion thus is a broad term. It covers all those errors of the logical operations as well which are not of the persistence or of the indirect delimitation, in any system of beliefs, which characterize delusions.

In mental pathology it is necessary to distinguish illusion from delusion (just used) and hallucination. In common parlance these terms are often confused, and many use them as if strictly synonymous. But this is not so among writers in psychiatry, for in this science these three terms are very clearly differentiated. And it is highly necessary that these distinctions should be observed, because these terms stand for very different phenomena in mental disease — phenomena of different value and importance, and each with its own special significance as to a patient's condition. An illusion is distinguished from an hallucination in a twofold manner. In an hallucination the trustworthy data are absent; that is, the determining elements in the construction are either purely imaginative or of organic origin. Both these cases manifest themselves on the border, or over the border, of the pathological. Hallucination is narrower in application than the word illusion. It is confined to the perceptual — to objects of sense in contrast with the delusion of the higher mental processes. The limits of the three terms among themselves is however largely practical. The central processes of illusion and of hallucination, arising from organic causes, are one and the same. In most cases of either, the influence of the delusional elements are due to the earlier condition of the mind — notably, to emotional states. The cases of so-called pure sense-illusion, on the other hand, are really cases of perception, not of illusion at all; since they are normal, constant and (contrary to the vulgar opinion) common to all individuals, and also exposed by resort to *tests* outside of the sphere of the particular sense concerned. Still a distinction between the usual and normal sense-deceptions and the abnormal and unusual false interpretations of sensory impressions and stimuli is very desirable. Some misinterpreting mental attitudes or factor seems necessary to the formation of the ordinary illusion. In the abnormal type of illusion its ætiology and nature is not much distinguished from hallucination. This fact is illustrated by the illusions of the insane. In the case of the insane, it is very difficult to decide whether there exists an illusion or pure hallucination, correlated with sensory and bodily elements. Ordinarily, when the mind is acting in a perfectly normal way and there is nothing to confuse its impressions or to obstruct its proper perceptive powers, a sensation, whether of the eye, ear, taste or skin is conveyed to the consciousness and is recognized correctly. Thus a sound, as the note of a bird or the voice of a friend; or the sight of some object, as of an animal moving in the distance, is properly conveyed to the intelligence and is properly recognized. But this process may be interfered with in various ways. Even the normal mind may make mistakes in the interpretation of sensations, and still more so may the mind that is impaired. It thus happens that all illusions are not necessarily evidences of a diseased mind; this faulty action of the senses, or of the perception, may and often does happen in the cases of persons of sound mind. For instance, a person walking along a path in the dusk may mistake a bush for an animal; he simply misinterprets an object and this object is not imaginary but has a real existence. So, too, the mirage which sometimes appears at sea, might lead a perfectly ignorant person to maintain that he saw a ship inverted sailing in the sky. These are instances of illusions in which the normal mind may be temporarily deceived. But the normal mind tends to correct its illusions, and this it does sooner or later according to its opportunity and its degree of knowledge. In this respect the insane mind differs from it; the illusions of the insane are usually firmly believed in; there is no spontaneous tendency on the part of the insane mind to correct its illusions. On the contrary, they are firmly embraced and are often made the starting point of a train of associated morbid ideas, whereby the mental disorder is all the more confirmed.

An hallucination differs from an illusion in the fact that it is entirely subjective. In a strict sense it is a disorder of perception in which the external sense organs do not participate and it leads to a belief on the part of the patient that he perceives some external object, whereas in fact there is no such object corresponding to the perception. In other words, it is a disorder of perception giving rise to a false belief in a sensation. For instance, a person believes that he hears the voice of an acquaintance speaking to him, when there is no voice either of the acquaintance or of anyone else; or, again, a person thinks he has a vision of a deceased friend or of some other spiritual being, whereas there is no external object or person whatever giving rise to this or any other sensation. The whole process, therefore, is subjective or within the patient's own mind; it is without any objective equivalent. It is thus readily seen that an hallucination is much more deeply seated than an illusion, and is a much more direct evidence of a disorder of the mind. Some authorities doubt indeed whether a true hallucination ever occurs in a normal person; what appears to be so in any given case would probably be found on strict inquiry to be an illusion. Although this may be an extreme position, the fact remains that hallucinations are very rare in the sane and very common in some forms of insanity; and that, as in the case of illusions the sane tend to correct them, while the insane adhere to them with unswerving belief. The most common hallucinations of the insane are the visual and the auditory, and they are sometimes very grave symptoms. Auditory hallucinations are especially dangerous, for they may lead the patient to commit acts of violence in response to their suggestions.

A delusion differs from both an illusion and an hallucination in the fact that it is not a sensory disorder — but a derangement entirely within the intellectual sphere. It is an erroneous belief, but one which is due entirely to mental disorder. The latter part of this definition is essential, because a delusion is essentially something more than a mere error of belief or judgment. It is an erroneous belief that is due to insanity, or to a disordered mind. Mere errors of belief may and do occur in persons who are sane: no person, in fact, is exempt. Such errors may be due to ignorance, prejudice or faults of education, but they are not evidence of insanity; otherwise the whole world would be insane. In the case, however, of an insane pauper who believes that he is a multi-millionaire, or that he is emperor of the United States, there is obviously something more than a mere erroneous belief in the sense of an error of judgment or opinion. Such a patient has developed an idea which no sane man in similar circumstances could have developed; in other words, he has a delusion, and he is not insane because he has the delusion, but he has the delusion because he is insane. The insanity or mental unsoundness is the fundamental fact and is shown usually by other symptoms besides the tendency to form delusions. As in the cases of illusions and hallucinations, the insane cling to their delusions with great tenacity; no argument, no logic moves them. The delusions of the insane are usually distinguished as systematized and unsystematized. In the former the delusion has a certain consistence, coherence and endurance; in the latter the ideas are more or less incoherent and changing. Delusions again may be expansive or depressive, according to the emotional tinge. See also IMAGINATION; INSANITY.

ILLUSIONS, Optical. See ILLUSION.

ILLUSTRATION OF BOOKS. There are two kinds of book-illustration: (1) an artist's attempt to make visual representation of scenes, or characters, or objects described in the text; (2) decoration and ornamentation for the purpose of embellishing the page. In both cases the illustration of books has followed the development of graphic art and the mechanical developments in the processes of book-making. The books that have been the most frequently illustrated are the Bible; the ‹Arabian Nights›; ‹Æsop's Fables›; the ‹Fables of La Fontaine›; the ‹Stories of King Arthur and his Round Table›; Dante's ‹Divine Comedy›; Perrault's ‹Fairy Tales›; Grimm's ‹Fairy Tales›; ‹Reynard the Fox›; and the plays of Shakespeare.

The earliest known illustrated work is the wonderful set of Egyptian papyrus rolls called ‹The Book of the Dead,› written 15 centuries before Christ. The pictures painted in colors prove, notwithstanding their stiff hieratic style, that the ancient Egyptians were expert draughtsmen and understood the art of producing direct illustration of very high pictorial quality. References in the writings of Latin authors show that illustrated books were very abundant in Rome in the libraries of the wealthy. These were manuscript books adorned by painters or by draughtsmen. The earliest specimen of an illustrated manuscript that may be seen by the public (and, perhaps, it may be the oldest Celtic manuscript extant), is the famous ‹Book of Kells,› dating from the 7th century and preserved in Trinity College, Dublin. The ‹Book of Kells› is not only a superb example of the scribe's patient handwriting, but its abundant colored pictures and large decorative initial letters and borders of the pages show that Celtic taste was highly advanced and that Celtic fingers were highly trained in the art of book-ornamentation.

During the Middle Ages books were the luxury of the wealthy. Comparatively few persons could either read or write. Learning was almost confined to the monasteries. The bookish man was usually a monk, for those who loved study usually entered the priesthood. Noblemen, as a rule, spent their time fighting or practising arms in the tilt-yard of the castle and their wives, daughters and sweethearts were occupied in household affairs or sat before their embroidery frames (see EMBROIDERY). In the evening the household and guests assembled in the great hall of castle or manor-house, where often some strolling minstrel or *trouvère* would recite, or chant, a famous story. Perhaps this would be one of the great Arthurian group, such as ‹Launcelot of the Lake› or ‹Tristan and Iseult›; perhaps one of the Charlemagne cycle, such as ‹Huon of Bordeaux›; or ‹Bertha with the Big Foot›; or one of the Crusader's tales, such as ‹Baldwin, Count of Flanders.› Such stories were called «Romans» and took the place of our modern novel. They were kept in circulation and made popular by these traveling minstrels and *trouvères* (as they were called in France), and would have been handed down orally, if unrecorded. Happily, however, in the monasteries and in private households, monks, scribes and painters copied these famous works and illustrated them, finding models and inspiration in what they saw around them. These specialists in the art of «illuminating» were lavish with their work which was of beautiful style, marvelous in minute detail and of exquisite finish. The small medallions, or pictures, called «miniatures,» were sometimes done by one person and the decorative initial letters and borders by another worker, who also inlaid the gold leaf, whence the adjective «illuminated.» Bibles, missals, breviaries, books of hours, books of music and dry chronicles were illustrated in like style throughout Europe. Wealthy lords purchased these superb books and specially ordered books for gifts from monasteries, when they did not keep their own artists. René d'Anjou had a staff of copyists and book-painters and his library was famed in the 15th century. Many of his sumptuous volumes are now owned by the Emperor of Austria. The Bibliothèque nationale in Paris owns the largest collection of «illuminated manuscripts» of the Middle Ages in the world. The British Museum also has a fine collection, including the ‹Harleian Ms,› and so has the Bodleian library in Oxford. The New York Public Library possesses some choice specimens of «illuminated manuscripts» and an excellent collection is permanently exhibited at the Metropolitan Museum in New York. A superb collection of «illuminated manuscripts» perished in the burning of the University in Louvain by the Germans in 1914 — an irreparable loss. Apart from their artistic beauty these «illuminated manuscripts» afford unlimited suggestion to decorators for motives of design and original lettering. They are, moreover, a storehouse of information for the historian, because the ancient illustrators depicted the scenery, architecture, costumes and personages that they saw around them. Many an old Flemish and French town appears in a Bible in a gold-brightened miniature as the artist's idea of Jerusalem, or Bethlehem, and many a contemporary king or queen masquerades as a Biblical character. In the case of Froissart's ‹Chronicles,› however, the painter depicted actual scenes and real portraits. Therefore the pictures in an illuminated Froissart are often more valuable to the modern student than even the vivid writing of the old French chronicler.

This particular kind of book-illustration came from the Byzantine monasteries and spread throughout Europe. Old Persian manuscripts show that the art is of Oriental origin. The same style of decoration was followed in embroidery; and church vestments were adorned with needle-wrought pictures similar to those in the «illuminated manuscripts.» See EMBROIDERY.

The fashion of book-illustration changed when printing was invented in the 15th century. Pictures drawn by the artist were now cut on blocks of wood by a special worker and inserted in the page of type. Some of these old wood-cuts were crude and rough with coarse lines and some were colored in gaudy hues. English billed sheets, called «broad-sides,» and chap-books sold by peddlers for a few pennies were illustrated in this way.

The Italian artists with their refinement of taste and imaginative qualities made the illustrated Italian books of the Renaissance veritable works of art. They are highly prized by the book-collector. The decorative title-pages, borders, vignettes, tail-pieces, initial letters and pictures produced by the Italians — particularly the Florentines — form a chapter by themselves in decorative art as well as in the art of book-illustration. The ornamentation of these Italian books can be compared only to the filagree-work of the goldsmiths of the Renaissance; and it is most natural that the designs should be similar, since many of the Florentine painters of the early years of the Renaissance were goldsmiths. Such was Sandro Botticelli (1444–1510), for example, whose illustrations of Dante's ‹Divina Commedia,› made in 1492 for Lorenzo di Pier Francesco, rank among the most wonderful of all engravings. One rarely thinks of Botticelli, the great painter of spring (‹Primevera›), ‹Venus Rising from the Sea› and the ‹Madonna of the Magnificat,› as an engraver; but these pictures for Dante's work, preserved, some in the Vatican and some in the Berlin Cabinet, show Botticelli as one of the greatest masters of the single line — almost Japanese in his simplicity and directness. These illustrations were sketched in silver print and finished with pen and ink. A few of them are in color. The style of the Rennaissance is to be found in every illustrated book of the 15th and 16th centuries, whether published in Italy, France, Spain, England, the Low Countries, or in the Holy Roman Empire (which included the present Austria and Germany). Every title-page was ornamented with leafy scrolls, mermaids, sirens, cupids' heads, sea-horses and mythological figures or interlaced strap-work; and every chapter and section began with a decorative initial letter and ended with a tail-piece. Even treatises on medicine and handbooks for the use of furniture-makers had such rich embellishments. On books of travel and geography the illustrators lavished all their skill. Maps appealed especially to the Renaissance illustrators and open to the student a vast field of information and to the decorator a world of design.

The books illustrated by Dürer (1471–1528) and Holbein the younger (1497–1543) are examples of the Renaissance as interpreted by the German mind. Holbein had great influence upon contemporary English taste, as he resided in England and was a great friend of the leader of taste and literature — Sir Thomas More. In the decoration of books the fashionable style of the day is always to be found. Therefore, in the days of Louis XIV we see the influence of Bérain and Lepautre taking the place of the Renaissance style. In the next period, that of the Regency and Louis XV, the styles of Watteau, Fragonard, Huet and Boucher are just as noticeable. Correspondingly in England the «Chippendale» style (derived from the Louis XV style) appears on many a title-page, exhibiting interlacing curves, rock-and-shell (*rococo*), dripping water, Chinese mandarins, pavilions and floral emblems. Then comes the pseudo-classic Louis XVI period, with its elongated ovals, slender lines, urns, trophies and classic ornamentation. It is only necessary for an expert to open a book in order to tell the period of its manufacture, even if there is no date on the title-page. Some of the most charming ideas and loveliest ornamentation are to be found in various editions of La Fontaine's Fables, Molière's plays and, in fact, all the plays and novels of the 17th and 18th century authors. The French have always excelled in the art of book-illustration, both in color and in black-and-white. Throughout the 18th century and until the last quarter of the 19th, when the half-tone process of reproduction was introduced, the artist's work was reproduced by means of the wood-cut, or steel engraving, or copper-plate etching. (See ENGRAVING). Nothing is more charming than the old wood-cut, which has a peculiar softness and delicacy. For the development of its technique Thomas Bewick (1753–1828), an Englishman, was largely responsible. Bewick was remarkable for his great precision of outline, his tint and his so-called «white line.» His illustration of ‹British Birds,› Gay's ‹Fables› and Æsop's ‹Fables› are classic. His contemporary, William Blake (1757–1827), was a remarkable instance of an inspired genius at creation and a master of technique. All artists study Blake's ‹Illustrations to the Book of Job› (1826). The next period of English illustrators is headed by George Cruikshank (1792–1878), who never quite gets away from caricature in which he was a master. Cruikshank is somewhat vulgar at times, but he has humor and often a delightful fancy. His illustrations of several old ‹Fairy Tales› appeal to artists. One can hardly ever think of Dickens' works apart from Cruikshank, who shares fame as a Dickens illustrator with John Leech (1817–64) and Hablot K. Brown (1815–82), known as «Phiz.»

It is interesting to speculate on how Thackeray would have treated the ‹Pickwick

Papers' if Dickens had given him the requested permission to illustrate them. William Makepeace Thackeray (1811–63), was almost as great a draughtsman as novelist. In his illustrations for his own novels — 'Vanity Fair,' for instance — he presents a world of humor, sometimes direct and sometimes subtle, which appeals as strongly to artists as to lovers of literature. Thackeray evidently inspired the work of W. S. Gilbert (1836–1911), whose delightful illustrations of his own 'Bab Ballads' are unsurpassed in the field of humorous drawing. Like Thackeray, Gilbert gets marvelous effects with the greatest economy of line. The pose of a dancer's foot, the sweep of a skirt, or the expression of the eye, are quite sufficient to excite laughter.

Of enormous influence in both England and America, as well as in his own France, was Gustave Doré (1833–83), a native of Alsace. Doré's chief illustrations were for editions of Rabelais (1854); Balzac's 'Contes drolatiques' (1856); Dante's 'Inferno' (1861); 'Don Quixote' (1863); La Fontaine's 'Fables' (1863); Milton's 'Paradise Lost' (1866): Tennyson's 'Idylls of the King' (1867); and Coleridge's 'Ancient Mariner' (1876). So popular were the pictures of this artist that there was practically a Doré cult for years. The next group of illustrators was headed by Sir John Millais (1829–96), who made successful pictures for an edition of Trollope's novels. Rossetti, Holman Hunt, Ford Madox Brown and others followed, and contemporary novels, stories and poems show the types and fashions of the day even better than the fashion-plates. Dante Gabriel Rossetti (1828–83) illustrated his own poem the 'Blessed Damosel' and the pictures enjoyed great vogue.

Of extraordinary decorative quality is the work of Aubrey Beardsley (1872–88), who in an edition of Pope's 'Rape of the Lock' allowed his fancy free play but restrained his hand for a fine display of technical skill. He also made a remarkable frontispiece for Ben Jonson's 'Volpone.'

For pure imagination, original treatment and magnificent technique nothing equals the illustrations made by Sir John Tenniel (1820–1914), for Lewis Carroll's 'Alice in Wonderland' (1866) and 'Alice Through the Looking-Glass' (1870). Tenniel so perfectly realized Lewis Carroll's ideas of Alice and the strange creatures she saw in her dreams that these books present one of the happiest examples of the illustrator's art. Tenniel also illustrated the 'Arabian Nights' (1863).

Hugh Thomson (1860), an English artist, has been nearly as successful as Austin Dobson in portraying the 18th century. His illustrations of Mrs. Gaskell's 'Cranford,' Jane Austin's novels, Charles Reade's 'Peg Woffington' and Goldsmith's 'She Stoops to Conquer' are charmingly treated with a light, sympathetic touch.

Another devotee of the 18th century is Randolph Caldecott (1846–86), whose delightful humor and trained brush and pencil turned to light work. He is best remembered in his series of nursery rhymes and ballads including 'John Gilpin,' 'Elegy of a Mad Dog' and the 'Great Panjandrum Himself.' Caldecott also illustrated Mrs. Ewing's stories (1878).

An illustrator who has had great influence upon the art of book illustration is Kate Greenaway (1846–1901). Her excellent drawing, her exquisite color and her graceful ornamentation are supplemented by a charming interpretation of the 18th century, resulting in a "Greenaway style." Miss Greenaway's illustrations for Madame d'Aulnoy's 'Fairy Tales' (1871) are not so well known as her illustrations of the poems of Jane and Anne Taylor, Browning's 'Pied Piper' and many nursery rhymes.

Another English woman-illustrator, Beatrix Potter, attracted attention about 10 years ago for her lovely color and quaint fancy and humor. Her illustrations to her miniature 'Peter Rabbit' books are masterpieces. Among illustrators in color, Walter Crane (1845–1915), is conspicuous. His best work has been done in illustrated books for children, such as the 'Baby's Opera,' the 'Baby's Bouquet,' 'Cinderella,' 'The Three Bears,' 'Masque of the Flowers,' etc. Walter Crane has also done beautiful work in black and white, including an edition of Grimm's 'Fairy Tales.' The latest illustrator in color about whose great talent three countries are agreed is Edmund Dulac (1882), a Frenchman, who now resides in London. He brings out, year after year, the most artistic books. Dulac ranks among the greatest illustrators of the present day. He is noted for his splendid and harmonious treatment of color and his poetic ideas. Dulac has illustrated the 'Arabian Nights' (1907); Shakespeare's 'Tempest' (1908); the 'Rubaiyat of Omar Khayyam' (1909); 'Sleeping Beauty and Other Tales' (1910); Edgar Allan Poe's 'Bells and Other Poems' (1911); and Hans Andersen's 'Snow Queen and Other Tales' (1912).

American illustrators have, generally speaking, followed the lead of English artists. One of the most original illustrators is F. O. Darley (1822–88), a New York artist, who did an enormous amount of work for magazines and illustrated a great number of books. Darley was not only a fine draughtsman, but he possessed vigor, style and fancy. Those who own editions of Washington Irving, James Fenimore Cooper, Nathaniel Hawthorne and Longfellow with pictures by Darley are fortunate. Darley's technique was drawn from the English school, but he was thoroughly American in style and feeling. He was too American to catch the spirit of Dickens; consequently, his illustrations to Dickens's works fall below his own standard, as shown in his treatment of American authors.

The most famous American illustrator of the 19th century was Edwin A. Abbey (1852–1910), whose sympathies turned to literary subjects. Abbey's illustrations to Shakespeare are admired in England as well as in America. He also illustrated many plays of the 18th century. Many American illustrators have attained just fame for skilful drawing and clever treatment of subject; and because of this general excellence few names stand out prominently and few Americans have attracted attention because of any single performance. Arthur B. Frost (1851–), however, achieved a triumph with his illustrations in pen-and-ink for the first series of 'Nights with Uncle Remus.' Frost caught the high imaginative qualities of Joel Chandler Harris and produced pictures that show a wonderful blending of the negro and animal set forth amid realistic Southern scenes and they exhibit a delicious humor. They are as closely identified with the text as Tenniel's pictures are with the text of ‘Alice in Wonderland.’

The invention of the half-tone process made the reproduction of photographs an easy matter. Illustrated books became more plentiful and cheaper, although, from an artistic point of view, the old woodcut, which gives a direct reproduction of an artist's work, take superior rank. In one particular, however, the half-tone photograph has fulfilled a mission in the illustration of books of travel. In olden days an album of pictures, drawn, or painted, by an artist — J. W. M. Turner, for instance,— and reproduced by steel engravings, was a gift book for the wealthy. Today, the more accurate camera and the quick and inexpensive half-tone have brought the illustrated book of travel within the reach of every purse.

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ILLYRIA, ĭ-lĭr'ĭ-ą, or **ILLYRICUM**, a name anciently applied to a considerable region on the east side of the Adriatic Sea, the inhabitants of which were the ancestors of the modern Albanians. In 228 B.C. it became a Roman province. After various vicissitudes under different rulers it formed part of the Franco-Napoleonic empire as the Illyrian provinces. In 1815 it reverted to Austria and became the kingdom of Illyria, a title it retained until 1849, when it was divided into the provinces of Carinthia, Carniola and the Coastlands. The inhabitants are Slavs, Germans and Italians.

ILLYRIANS, the people who about the time of Herodotus dwelt on the eastern shores of the Adriatic Sea. Little is known of their racial origin. They were represented as a barbarous people by the Greeks, but archæological research shows the stages of their civilization from the Neolithic Age onward. Implements of iron and bronze, silver, amber and glass ornaments attest a high degree of culture. In Dalmatia they were mixed with the Celts, and Celtic place names are common there to the present day. The Albanian language is probably derived from one of the two groups into which the ancient Illyrian tongues were divided. Consult Brugmann, K., ‘Kurze vergleichende Grammatik der Indogermanischen Sprachen’ (Strassburg 1904).

ILMENITE, or **MENACCANITE**, also known as titaniferous iron ore, is a black, heavy, mineral crystallizing in the hexagonal system. It is widely distributed, occurring in diorites and many other igneous rocks. It is an oxide of iron and titanium containing when pure 36.8 per cent iron and 31.6 per cent titanium, and is frequently associated with magnetite. Iron ore containing ilmenite occur in vast masses in the Adirondack region of New York, in Quebec, Canada, and in northern Minnesota, and ilmenite is a common constituent of the black sands found on some ocean beaches. The presence of titanium decreases the fusibility of an iron ore, hence the failure of many attempts to work back sands in the blast furnace. It is likely, however, that the titaniferous iron ores will become important sources of iron by the development of special methods for their treatment. See TITANIFEROUS IRON ORES.

ILOCOS NORTE, ē-lō'kōs nōr'tā, Philippines, a province of Luzon, occuying the northwestern part of the island; greatest length, 79 miles; area, 1,265 square miles (including the dependent island). Chief town, Laoag. Two mountain chains inland extend parallel with the coast; the surface otherwise is much broken by foothills, but it is fertile and well watered. Among the natural wonders of the province is a grotto 39 acres in extent and of great beauty, situated in Lice Mountain. The products include rice, cotton, chocolate, corn, sugar and a fair grade of tobacco; there are deposits of iron and copper in the mountains, the latter having been worked by the natives. The chief industries are agriculture, horse and cattle raising, fishing and the weaving done by the women. Civil government was established in September 1901; the people of the province are among the most progressive and industrious of the native races. Pop. 179,000, mostly Ilocanos and Igorot.

ILOCOS SUR, soor, Philippines, a province of Luzon, on the west coast, bounded on the north by Ilocos Norte and on the south by Unión; length 70 miles; area 492 square miles (including dependent islands). Chief town, Vigan. The eastern boundary consists of a chain of mountains rising 4,150 feet in Nagupu and sloping toward the coast in terraces; the rivers are small. The coast road runs through the province from north to south, connecting the important towns and villages. The soil is fertile, the principal products are rice, corn, sugar, indigo, chocolate, peanuts and vegetables; the chief industries, other than agriculture, are the weaving of cotton cloth, the manufacture of baskets, hats, card cases and pipes, and cattle raising. There is also considerable trade, carried on mainly through the native markets in the different towns, and some export. Civil government was established 1 Sept. 1901. Pop. 187,500, mostly Ilocanos.

ILOILO, ē-lō-ē'lō, Philippines, province of Panay, including the eastern and southeastern coast of the island; greatest length, 111 miles; area, 2,102 miles (with dependent islands). A range of mountains follows the northern and western boundary lines; the rest of the surface is undulating, sloping to the sea. There are several large rivers, the most important being the Jalaur and the Jaro. This province has some of the best roads in the archipelago; the principal towns are connected with the capital, Iloilo, and some of the rivers are navigable for native boats to the foot of the mountains. The products include sugar-cane, corn, rice, coffee, chocolate, tobacco and hemp; there are also in the province deposits of gold and iron, stone quarries and extensive forests. The chief industries are live-stock raising, the weaving of fabrics of pineapple fibre (piña) and cotton and the manufacture of sugar. In

1899 the United States troops occupied the province, immediately began operations against the insurgents who were located there with headquarters at Santa Barbara, and succeeded in dispersing their forces. In April 1901 civil government was established. The inhabitants are mostly of the Visayan race and are generally Catholic, though some of the mountain tribes are still heathen. Pop. 423,500.

ILONGOT, ĭ-lŏn'gŏt, or **IBALAO,** e'bạ-lou, a primitive people of Malayan stock, who dwell in northern Luzon, P. I. They are head hunters and are among the least known and least civilized tribes in the Philippines. Their dwellings are scattered and their social organization is of the most primitive and simplest type. They number about 3,000.

ILOPANGO, ē-lō-pän'gō, Salvador, Central America, a lake of volcanic origin, six miles southeast of the city of San Salvador, about 10 miles long by 6 miles broad. It has several islets, one of conical shape about 400 feet high, formed during a volcanic eruption in 1879–80. Fish abound, although the waters exhale a disagreeable sulphurous odor, and are unpotable. The surface of the lake is 1,200 feet below the level of the surrounding country; when ruffled by a breeze the waters have a singularly brilliant parrot-green color. It is regarded as one of the most beautiful lakes in Central America, and is a resort for the people of the capital.

ILORIN, ē-lŏ'rēn, or **ALORI,** ă-lŏ'rē, West Africa, the capital of a province in British North Nigeria, 170 miles northeast of Lagos. It is encircled by an earthen dyke and has several mosques. The principal industries are leather-making, pottery, wood-carving and cloth weaving. Mohammedanism is the religion of the majority of the inhabitants. Pop. about 60,000.

IMAGE, in optics, the picture or impression produced by the luminous rays from an object reflected or refracted in mirrors or lenses when they enter the eye of an observer as if they had proceeded from a representation of the object. More correctly, the image is the locus of the foci (or circles of least confusion. See Focus) of rays from consecutive points of the object. When the light rays actually pass through the points of the image the image is real and may be thrown upon a white screen. If no screen is interposed the image can be seen by an eye placed in the pencil of rays which pass through it. When the light rays do not actually pass through the points of the image, but diverge from one another on leaving the mirror or lens, the image is said to be virtual, and cannot be thrown upon a screen; it becomes visible to an eye placed in the pencils of rays which appear to have passed through it. See Lens; Mirror; Optics.

IMAGE, Psychological. The term as employed in psychology has two different meanings. Traditionally, the image is a copy or representation of a former perception, or a compound of such representations, as for example, the picture we see when with closed eyes we recall or imagine some object. Such an image, however, is complex, and by analysis it reduces to a number of simple images which synthetically combine to form an idea just as a number of sensations combine to form a perception. A more careful terminology, therefore, would regard the image as simple and would define it as «an elementary mental process, akin to sensation and perhaps indistinguishable from it, which persists when the sensory stimulus is withdrawn or appears when the sensory stimulus is absent.» (Titchener). Notwithstanding the greater accuracy of this second definition we shall (since we are interested primarily in the general nature of imaginal experience), employ the term in its common rather than in its technical sense. We shall, therefore, take the image to mean the conscious representation of former experience.

It is a moot question whether the image differs psychologically from sensation. Some psychologists believe that the image is more filmy and faded out than sensation, and that its intensity and duration are characteristically less. But to this it is replied that these are differences in degree, and not in kind; that sensations themselves show these differences. The only certain distinction, therefore, is logical rather than psychological; we say that we have a sensation when the stimulus is present and an image when the stimulus is absent. In everyday life, of course, there are still other cues which are taken by the individual to mark off sensory from imaginal experience; images are frequently less distinct, they are of shorter total duration, they fluctuate, they fade out and disappear, they do not belong to the situation in which at the moment we find ourselves, etc., but all these when taken as cues are meanings which we put upon the bare experience, and, therefore, we often find that we are wrong, that the experiences which we take to be perceptual are, after all, imaginal.

If, however, we compare different kinds of image, then we find some that are clearly more like sensations than others. One group contains images which are conditioned upon recent stimulation of the sense-organ. The positive after-image which has the same quality as the sensation which precedes it, the negative after-image which always appears in an antagonistic quality, and the memory after-image which is similar to the positive but has other conditions — all three occur upon the cessation of the stimulus, and are undoubtedly sensory in character.

There are others, which we may call concomitant images because they fill out or occur concomitantly with perception, that are not so obviously sensory as those in the first group. The memory color image by means of which we always see an object in the same color quality that is familiar to us in daylight; the «tied image» which, for example, appears in mutilated letters or outline drawings as gray lines or patches of color, and thus fills out the lacunæ in the perception; and finally the image of synæsthesia, the best known example of which is colored hearing (sound accompanied by color) — all of these have the marks of sensory experience as regards their relative stability, uniformity of occurrence in the same individual, and their concomitance with other sensory experience; but, on the other hand, they appear also to be conditioned upon associative tendencies in the brain, i.e., we see objects according as they mean, or, as in synæsthesia, there is probably some abnormality among the associative fibres. Images in this group are, therefore, peripheral in character but centrally initiated.

There remain still other images which are dependent neither upon recent stimulation, nor upon concomitant perception but only upon associative tendencies. There are two kinds of these "free images," the image of memory and the image of imagination. So long as the images are simple, psychology is unable to distinguish them, but in the complex form they are accompanied either by the feeling of familiarity or by the feeling of strangeness. In the former case the idea comes to us as consciously familiar, and we call it the image of memory; in the latter the idea comes to us as new, and we designate it the image of imagination. When once we have learned to recognize them, however, we find that their life histories are not the same. The image of memory, for instance, is subject to change in the course of time — it may fade out, it may approximate to a type, or it may be incorporated into a new complex part of which is imaginal. The image of imagination, on the other hand, is more stable, it may maintain both form and quality for a long time and then it dies away. Furthermore, an image of memory may appear in different modes without change of meaning, e.g., a series of nonsense syllables may be learned visually and recalled verbally, whereas the image of imagination cannot be replaced by imagery from another sense department.

All modes of sense experience may be represented in imagery. But visual images are most common; then, in descending order of frequency comes auditory, touch and temperature, pain, taste and smell, and finally kinaesthetic and organic images. Kinæsthetic imagery is so similar to kinæsthetic sensation that it is distinguished with difficulty, and auditory imagery so frequently occurs concomitantly with throat-kinæsthesis that the existence of pure auditory imagery has mistakenly been called into question.

Finally there is large individual variation in the nature and frequency of characteristic imagery. In some individuals imagery is clean cut and intensive; in others indistinct and weak. Again, in some individuals nearly all forms are experienced; in others scarcely any imagery is to be discovered. It has been found, however, that an individual's imagery tends to conform to one of four types. There is first a versatile type which employs visual, auditory and verbal-kinæsthetic images without preference for any one. Secondly, there is a visual type in which visual imagery is predominant although verbal-kinæsthetic imagery is also used. Thirdly, there is an auditory-kinæsthetic type, and finally, an almost purely verbal-kinæsthetic type. It should be remarked, however, that these types are only approximations. The kind of imagery which an individual employs at any given moment depends in large part upon such varying conditions as age, mental habits and the circumstances of that moment.

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IMAGES, Veneration of, the practice of venerating, worshipping and honoring in public or private graven or painted representations of sacred things or persons. Because of the general prevalence of idolatrous worship of images, the Jews in the Old Law were forbidden the making of images, although evidence of the lawfulness of the practice is afforded in the positive command to "make two cherubim of beaten gold on the two sides of the oracle," to "make a brazen serpent and put it up for a sign." Though the walls of the catacombs, which were the refuge of the first Christians in times of persecution, show many symbols, such as the anchor, palm branch, dove and fish, it was not those primitive believers who introduced images and pictures into the churches. Indeed, during the great struggle against heathenism, there was a strong opposition to any form of idolatry. It was not until after the period of the persecutions that the use of sacred images or paintings became open and undespised. The Council of Elvira (A.D. 306) decided against the use of pictures in churches, yet during the following 90 years pictures of martyrs and saints were set up in sacred edifices. The representation of Christ in the form of a man was ordained at the Sixth General Council (Constantinople 692), instead of, as heretofore, under the symbol of the Lamb. Images of the Holy Trinity were later sanctioned by the Second Council of Nice (787), though a distinction was laid down between adoration (*latreia*) and reverence (*douleia*), the latter to be paid only to the persons represented, and not their images. With the spreading of the custom came the adoption of incense and candles. A school of iconoclasts — image-breakers — arose in the Eastern Church during the 8th century, entirely condemning not only the veneration paid to the images, but even the existence of them. In 726 the Emperor Leo III prohibited the practice and soon after (730) ordered the images to be destroyed. The Church split into two parties over the question, each in turn persecuting the other. The controversy, which lasted over a century, was ended under the Empress Theodora by a council at Constantinople in 842 declaring in favor of image worship among the Greeks. The decision was confirmed by another council in 869–70. In the modern Greek Church *ikons* or pictures are permitted, but no graven images; in the Roman Catholic Church the use of images was continued. Though not accepted by the English Church of that period, images were later introduced. Consult Damascene, 'Treatise on Holy Images,' translated by M. H. Allies (1898).

IMAGINARY CONVERSATIONS. Opinions may differ as to the relative position of Landor's 'Imaginary Conversations' among the major classics of English prose, but the right of the book to be numbered among them can scarcely be called in question. The 'Conversations' have never been popular in the broad sense of the term, nor did Landor intend them to be so. It was always his endeavor, in the phrase of Bacon, "to single and adopt his reader." To read the 'Conversations' with pleasure requires not only a considerable background of learning, especially in history, but also a respect for and sensibility to refined literary style. In the 'Conversations' Landor attempted to restore to life, as far as the imagination can do so, illustrious or at least interesting characters of the remote and the near past, to set them in a situation congenial to their self-expression, and then permit them to reveal in dialogue what to Landor seemed their significant phases of mind and personality. The incidents of the action which Landor employed are not usually recorded events of history, but constructions of his own imagination fashioned to harmonize plausibly with his characters. This imaginative revivification of personality was not merely pictorial, not merely objectively dramatic in intent. Landor's effort was to do more than tell a story, it was to picture the souls of his personages, to show how they may have felt and thought. This was obviously the most difficult task he could have set himself, calling as it does both for the scientific accuracy of the historian and the creative exuberance of the poet. The 'Conversations' cover, moreover, an extraordinary range of subjects, including statesmen, philosophers, scholars, writers, soldiers and what for lack of a better term, we may call gentlemen and ladies, from almost every civilized people of the world. They differ considerably in length, in method of treatment, and also in interest. Occasionally we have the feeling that the dialogue is not really conversation, that speech succeeds speech without much relation to the character of the speakers, so that the names of the characters being removed, we seem to have an uninterrupted flow of comment on an idea. This happens when the characters have not been found with a really vital situation. Not a few inaccuracies in matters of detail have been pointed out in the 'Conversations,' and occasionally the dialogues seem longer than the importance of their thought justifies. But all qualifications having been made, the 'Conversations' still remain distinguished for their learning, their wisdom, and above all for their sympathy with the intellectual passions of mankind.

Various attempts have been made to classify the 'Conversations,' sometimes as to subject matter, sometimes as to the difference of manner or spirit in which they were written. Landor, however, seems to have had no system in mind when he composed them. They were written at different times, in the end reaching a total of about 150, over a wide stretch of years, but they were not produced according to a program, and consequently cannot well be reduced to one. Individual moments of life interested Landor most, not general states of society or complicated sequences of events, and therefore one would not look for a high degree of organization in the relation of the dialogues to each other.

Perhaps the least contestable merit of the 'Conversations' is their possession of the virtue of style. It is customary to speak of Landor's style as classic, and so it is in its restraint and evenness, in its unfailing sense for dignity and beauty of form. It is not, however, the monumental and oratorical style of Roman prose that one thinks of in reading Landor, but rather Greek prose style, with its nice balance between colloquial ease and literary formalism. Landor passes lightly from familiar conversation or exposition to the language of poetry; often of restrained eloquence. Perhaps his most charming passages are the short idyllic and lyric amplifications which are to be found in every 'Conversation' the subject of which permits such graceful embroidery. More serious passages are cast in severe but never elaborately artificial form. Indeed Landor's prose is always easy, though never realistically familiar, always consciously artistic, though never painfully labored. It has neither the rapidity, nor the curtness, nor the concealed ingenuity not infrequently found in later English prose. It is distinctly a 19th century prose style, but about it there still lingers some of the serene dignity of the literary ideals of the preceding century. In this sense also Landor's prose may be designated as classical.

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IMAGINARY QUANTITY. An imaginary or complex quantity is an expression consisting of a pair of real numbers, or numbers which can be represented by positive or negative terminating or non-terminating decimals. The pair consisting of a and b is written $a+ib$, which is in general different from $b+ia$. A complex quantity of the form $a+i.0$, is said to be real, but must not be confused with a number which is real in the primary sense, notwithstanding the many common properties which the two possess. A complex quantity of the form $0+ib$ is called a pure imaginary. If x be the complex quantity $a+ib$ and y is the complex quantity $c+id$, $x+y$ is defined as $(a+c)+i(b+d)$, and xy as $(ac-bd)+i(bc+ad)$. Most of the theorems of arithmetic and algebra suffer no loss of validity by their transference to complex quantities, while, as was proved by Gauss, every algebraic equation in complex algebra has at least one root. For this reason, complex algebra is the algorithm of mathematicians *par excellence*.

$0+i.1$, or i, as it is written, has the property that its square is -1, so that it is often written $\sqrt{-1}$. It cannot be defined as $\sqrt{-1}$, however, for in ordinary algebra $\sqrt{-1}$ is meaningless, and operating with meaningless symbols yield sheer nonsense. On the other hand, if we start with complex algebra, the symbol i is usually one of the initial concepts.

The so-called Argand representation of the complex number $(x+iy)$ is the point (x, y) on a Cartesian co-ordinate-plane. If the angle between the x-axis and the line from the origin to (x, y) be θ, and the distance from the origin to (x, y) be ρ, we get the result that $x+iy=\rho(\cos\theta+i\sin\theta)$. It may be shown that $[\rho(\cos\theta+i\sin\theta)]\,[\rho'(\cos\theta+i\sin\theta')]$

$=\rho\rho$ $\{\cos(\theta+\theta')+i\sin(\theta+\theta')\}$, so that the multiplication of two points on the Argand diagram is attained by adding their θ's or *arguments* and multiplying their ρ's or amplitudes. The addition of two points results in a point which forms a parallelogram together with them and the origin.

IMAGINATION. Early in the history of psychology, imagination meant nothing more than the ability or power of having mental images. (See IMAGE, PSYCHOLOGICAL). Later, a distinction was made between the imaging of previous experience (reproductive imagination), and the forming of new images from the old (productive imagination). Still later, the former was subsumed under the term «memory,» and the latter became the sole meaning of imagination. As now understood, however, imagination is something more than the mere having of discrete images or ideas. It is rather a sequence of mental processes which is directed in its course either by the perceptions or feelings of the moment (passive imagination), or by some dominating idea or disposition which looks to the creation of a new object (creative imagination). Psychologically regarded, the characteristic process of this consciousness is the image of imagination. But, psychologically again, it is wrong to suppose as some psychologists have formerly supposed, that the images in and of themselves may combine to form novel compounds. Hobbes says, for instance, that «when a man compoundeth the image of his own person with the image of another man, as when a man imagines himself a Hercules or an Alexander, . . . it is a compound image.» Hobbes was led into this error because he did not distinguish between the image as bare unmeaningful process and the image as object, as logical meaning. We now know that the meaning which the image carries is not intrinsic to the image, that it may be carried by other processes than the image, and that under certain circumstances it may have no representation whatever in consciousness. Furthermore, all associations, i.e., combinations, are functions of meanings; there is nothing in the images themselves to condition their combination. But when a new meaning has been reached we may find in consciousness an imaginal process which carries the new meaning, and which, when regarded as object, may bear the likeness of the object meant. Only in this way may a compound image such as Hobbes describes be attained.

This image, the image of imagination, appears only in minds of a certain constitution and its mode varies, of course, according to differences in ideational type. In some cases the imaged object is so complete and distinct in form and so stable in quality that it serves as a guide to the artist who undertakes a formal expression of his new creation. Legouvé, for example, is said to have remarked to Scribe, «When I write a scene I hear, you see; at each phrase which I write, the voice of the person who is speaking strikes my ear. You, who are the theatre itself, your actors walk, act before your eyes: I am the listener and you the spectator.» «Nothing could be more correct,» Scribe replied; «Do you know where I am when I am writing a piece? In the middle of the parterre.» We know also that Goethe and Dickens visualized their scenes and that the latter heard his characters speak; that Schubert, Mozart and Beethoven heard their music before it was expressed in notes and that some painters have had visual ideas so stable in form and color as to serve as models.

The image of imagination is, as has been said, the characteristic feature of the imaginal consciousness. But like the patterns of thought and action, the imaginal is a determined consciousness; the ideas proceed in an orderly way. In passive imagination the images follow the course of perception as when we see the incidents related by a story-teller, or hear the character speak in the drama we read. In these cases, as Titchener says, «a certain indefinite direction is given to our ideas by the presented stimuli; then the ideas as they come in their predetermined order, are supplemented in this imaginal way.» In constructive imagination, on the other hand, the successive ideas not only have a direction, but they also drive forward to an end, namely, the new creation. The determining factors here are dispositions in the nervous system which may or may not find conscious representation. In the first place we have what Ribot calls the «instinct of creation, the need of producing in a determined line.» This, if mentally expressed, comes as a vague ambition or aim, and the disposition serves to restrict all ideas that do not fit in with the ambition or aim. Then without warning but usually after long incubation and as the result of some chance situation, or some grouping of associative tendencies, a new meaning, a happy thought, is born. If the new meaning is carried in consciousness by an image and if it has upon it the feeling of strangeness, then it is the image of imagination. The feeling of strangeness, however, alternates with a feeling of satisfaction, of joy, sometimes of exaltation. It is not surprising that in view of the suddenness of its initiation, its unaccountableness, its feeling of strangeness and the joy which it brings, the new idea often seems to come as an inspiration from on high. Sometimes the new conception comes in its complete form. George Sand, for example, says of Chopin: «Creation was spontaneous, miraculous; he wrought without foreseeing. It would come complete, sudden, sublime.» But at other times and more frequently, the new idea is vague, incomplete, or only in outline, and the period that follows is one of hard labor characterized by secondary attention, conflicting ideas and variable moods. This is the period when the painter cleans and recleans his canvass, the musician writes and rewrites his themes, the poet casts and recasts his lines. But all the while the image of imagination serves both as model and as goal assisting the dispositions in keeping the imaginal consciousness true to its course.

There remains to mention a third feature of the imaginal consciousness, the feeling of empathy. There seems to be a natural tendency for an individual of the imaginal type to feel himself into a situation. It is not enough for the artist to picture the scene he creates; he becomes a part of it. He not only invents a character; he lives it. Scribe projected himself into the pit and watched his actors act; he might equally well have become the characters themselves, as Dickens became Little Nell and suffered as she suffered. Psychologically, empathy is a conscious attitude that analyzes into images of imagination and kinæsthetic sensations. Its counterpart in perception and memory is imitation.

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IMAGO. See Metamorphosis.

IMAM, ĭ-mäm, or -mâm′, a Mohammedan chief or leader; a title given to the four successors of Mohammed, and to the 12 great leaders of the shütes. In Turkey, applied to the functionaries who call the people to prayer from the minarets, perform circumcision, etc. They are chosen by the people, and confirmed by the secular authority, under whose jurisdiction they also are in criminal and civil affairs.

IMBECILE, weak or feeble in mind. The ordinary use of this term is to express a degree of mental weakness somewhat less than idocy. See Mental Defectives.

IMBECILITY. See Mental Defectives.

IMBER, ĭm′bĕr, **Naphtali Herz,** Hebrew poet: b. Zloczow, Galicia, 1854; d. 1909. In his boyhood he was well trained in the Talmud, and for purposes of study traveled in Turkey, Egypt and Palestine, becoming most proficient in Hebrew and other Oriental languages. He went to England and for some time was a collaborator of Israel Zangwill. He came to the United States in 1892 and traveled about extensively, living successively in New York, Boston, Chicago, San Francisco and Los Angeles. He published several volumes of verse and contributed numerous articles to the Hebrew press. His works include ‘The Mystery of the Golden Calf’; ‘The Keynote to Mystic Science’; ‘The Treasures of Ancient Jerusalem’; ‘The Letters of Rabbi Akibah’; ‘The Education of the Talmud’; ‘The Music of the Psalms’ and the hymn ‘Hope of Zion.’

IMBRIANI, ĕm′brē-ä′nē, **Vittorio,** Italian poet: b. Naples, 24 Oct. 1840; d. 1 Jan. 1886. He pursued historical and philosophical studies at Naples, Zürich and Berlin; later became a soldier, serving in the wars of 1859 and 1866; and had a political career marked by much antagonism caused by his passionate and fearless temperament. The best known of his works are ‘Canti populari delle provincie meridionali’ (1871–72); ‘Dodici canti pomiglianesi’ (1876) and ‘La novellaja fiorentina’ (1877). Distinctive of his critical work is ‘Fame usurpate’ (1877) in which he analyzes as a worthless production Goethe’s ‘Faust.’

IMBRICATED SNOUT-BEETLE. See Snout-beetle.

IMBROS, an island in European Turkey, west from the entrance to the Dardanelles. It is 18 miles long, east to west, 8 miles broad, and terminates west in Point Auflaka, and east in that of Basse. Area, 87 square miles. It is mountainous, rising in its loftiest peak to the height of 1,959 feet; well wooded, and intersected with richly-fertile valleys, producing wine, honey, oil, cotton and lead. It has only two towns — Flio and Castro. Pop. 8,000, mostly Greeks.

IMHOFFER, ĕm′hōf-ĕr, **Gustav Melchior,** Austrian Jesuit and explorer: b. near Graz, Styria, 1593; d. 1651. Entering the Jesuit order he was sent as missionary to Peru in 1624. In 1636 he crossed the Andes and reached the head waters of the Amazon. He was the first European to make a connected account of the whole course of that river. It was first published at Madrid in 1640. The London edition of 1689 is entitled ‘A Relation of a Journey along the River Amazon.’ Subsequently Imhoffer was made director of the College of Bahia. The Society of Jesus published a number of works by him on the peoples, languages and customs of the aborigines who came under his notice.

IMIDE, ĭ-mĭd, or -mīd, a chemical substance derived from ammonia, NH_3, by replacing two of the hydrogen atoms by a divalent radical. If all three of the hydrogen atoms of the ammonia are replaced by one trivalent radical, the compound is called a nitrile. When one or more of the hydrogen atoms of the ammonia are replaced by a corresponding number of monovalent radicals the compound thus formed is called an amide or an amine, according to the nature of the radical by which the hydrogen is replaced. See Amide; Amine.

IMITATION. Imitation is the process of reproducing by one’s own act the observed actions of others. Its beginnings lie therefore in perception. It is the result of a desire to change from the rôle of spectator to that of actor. Imitation may be of two kinds (1), a primitive and (2) a developed form. The primitive form is an unconscious copying of some object of perception; and is simply a reaction in response to the outer stimulus which excites it. The best example of this kind of imitation is to be found in the sounds which a baby is wont to repeat when it has once heard them. It is a peculiar characteristic of the primitive imitation that the sound, for instance, when once imitated becomes in turn a new stimulus to start the process over again, the result being that the imitated sound is repeated rapidly again and again until the organs are wearied, or the attention is diverted. The exercise is evidently found to be pleasurable, and is therefore continued indefinitely. Mr. Baldwin has given the name “circular reaction” to this kind of self-perpetuating process. The name also of “suggestive imitation” has been given to this class of acts which appear imitative to an observer, but are not consciously felt to be so by the imitator.

The second form of imitation is more complex, and marks a more developed stage of consciousness. The imitation has now become a conscious act. The object perceived has aroused some degree of interest, and there is consequently a conscious effort to reproduce it with the original set before one as a model. In imitation which is of this form, we find the process intimately connected with the attention. In attention there is always a conscious striving for a more accurate knowledge of the object of perception, and imitation serves to gratify this desire, inasmuch as one comes to closer quarters as it were with any act when one tries to reproduce it. Knowledge of it comes then from the inside. This means a concentration of attention, and a consequent result of more definite and satisfying knowledge. Moreover, attention will vary as the interest, for that which one attempts to do himself is always far more interesting than merely that which is observed.

In the development of consciousness imitation as a social factor plays a most conspicuous part. Through it a child acquires all of its social tendencies, and becomes a part of the social organism in which it is to live and move and have its being. Its education starts with the first rudimentary efforts at imitation; and is carried on from this initial stage to the very highest and most advanced forms in constant dependence upon the imitative tendencies. Through imitation the knowledge of one generation is acquired by the succeeding, and a continuity in development is assured which makes for the progress of the race.

In this connection it is to be noted, however, that with the imitative impulse there are two other tendencies which have free play and a wide scope. These tendencies must be reckoned with also. They are the tendency to social opposition, and the tendency to inventiveness. The tendency to social opposition is a desire for self-assertion, an impulse primarily to do something different from that which others are doing merely from a feeling of native opposition. This impulse is seen in very young children, and remains throughout life. It is often recognized as unreasonable, but nevertheless irresistible. It is a fertile source of the differences of opinion which so early develop in childhood. It prevents a slavish imitation and the loss of initiative in action. However in order to act in a manner which differs radically from one's social environment, there is implied a preliminary training of an imitative sort; for there must be a basis of common activity in order that a departure from the accepted mode may have any significance, and there must be also a body of common beliefs, in order that there may be any such thing as real difference of opinion. The other tendency is a more pronounced and a more definite form of opposition to imitation; it is the tendency to inventiveness, not for the sake of opposition, nor as the result of an inevitable clash of opinion in one's social setting, but for the sake of producing that which is suggested from within, and not from without. It is the working out of one's own individuality without waiting for a copy or model. It is a shifting of the centre of interest from some object which is perceived, to some object of the inner sense, a fancy born within the brain, an idea which has its origin in the depths of one's own consciousness. This tendency is seen even in early acts of imitation, a tendency to depart from the copy, to introduce variations of design, to improve upon the model.

Here again in order that there may be increased power of independent production, there must be a previous schooling in the art of exact imitation. The original artist is not one who has never copied from a model nor studied the works of the masters. It is the interplay of the imitative impulse with the tendencies to social opposition and to inventiveness which make progress possible. Progress is not repetition nor is it on the other hand activity which swings clear of any past. Where there is progress there is imitation, but the kind of imitation which allows full range for inventive play and independent opinion.

There is a special form of imitation which appears on a large scale in the so-called mob impulse, where individuality seems merged in the tendencies of the mass, and imitation is in the nature of a reaction. The individual is swept along with the crowd, not because he wills it necessarily, but because the action of the crowd carries him away as with a flood. This kind of imitation has been given the name of «plastic imitation.» Much study has been devoted of recent years to the relation of imitative impulses in animals to congenital tendencies. The instinctive furnishes a strong predisposition to imitation, and in many of the early activities of animals it is most difficult to draw a line of distinction between instinct and imitation. See IMITATION IN ANIMALS; MIMICRY IN NATURE.

Consult Bagehot, 'Physics and Politics' (New York 1873); Bain, A., 'Senses and Intellect' (London 1888); Baldwin, 'Mental Development in the Child and in the Race' (New York 1906); Bosanquet, B., 'History of Aæsthetic' (New York 1892); Frazer, 'The Golden Bough' (London 1911); McDougall, 'Social Psychology' (London 1908); Wundt, W., 'Völkerpsychologie' (Leipzig 1900).

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IMITATION IN ANIMALS. This is a somewhat technical phrase used in zoology to designate the fact that certain kinds of animals have acquired, by the gradual process of natural selection, a resemblance to other animals, which are said to be «imitated,» although, of course, no effort to become like them is consciously made. This is one of the two principal phases of what is called «protective resemblance» the other being an acquired and protective likeness to some vegetable or inanimate object that causes it to be overlooked by its enemies; this second phase is termed «mimicry,» and is described under that head. While the advantage gained by mimicry is that the animal is either overlooked altogether, or else mistaken by its enemy for something of no value to the latter, that gained by imitation is that the animal is avoided by predatory kinds because it is mistaken for something harmful or at least distasteful. The methods by which, according to the theory of Darwin and his followers, these conditions are matured are explained in the article NATURAL SELECTION; but it should be said that other, or at any rate modified, views of the method have been advanced by other and later writers.

The most widely quoted and typical case of apparently advantageous imitation is that of the South American heliconid butterflies, which are evil-smelling creatures so distasteful to both monkeys and birds that they are very rarely if ever eaten, and hence fly about in the sunshine as carelessly as if they knew they were safe. Now, in the same situations are found butterflies of an entirely different family (*Pieridæ*) that have none of the inedible qualities of the heliconids, and they, too, fly about freely and are rarely if ever caught, or attempted to be caught by creatures that prey on butterflies, although both are rather clumsy fliers. The conclusion then seems logical that the pierids are getting benefit from their masquerade, however it may have come about. Similar cases of imitation among butterflies may be found in all parts of the world, in some groups a whole genus affecting a more or less close imitation of another genus or family, and elsewhere only a single species in a genus approximating some unrelated form; furthermore, cases occur where the female alone of a species will imitate another species, whereas the male acquires no such resemblance; this seems to follow the rule, so widely illustrated in all classes of animals, that nature provides for the preservation of the female far more carefully than for the male, who in the inferior ranks of life at least appears to be of little or no importance after he has performed the duty of fertilization.

Many notable illustrations of our theme may be gathered among the insects of the United States. A conspicuous one is the case of one of our large butterflies of the genus *Basilarchia*. All the species of this genus, with one exception, are dark-colored, with a light border containing blue spots round the margins of the wings, as in the common «mourning cloak»; the single exception is *Basilarchia hipparchus*, which has a tawny brown color, diversified by black bands and marks. This brown basilarchia almost exactly copies our very common milkweed butterfly (*Anosia plexippus*). Here there seems no adequate motive for, or advantage gained by, the apparent imitation, and it suggests when it is closely studied various difficulties in respect to the whole subject.

But not all cases of this adaptation are confined to resemblances between two insects or other creatures of the same class. A certain butterfly becomes an almost precise duplicate of a dragon-fly; spiders in both North and South America take the form of ants, and a well-known small black wasp of our own country is so ant-like that it is called the cow-ant or velvet-ant. Few town-bred persons go into the country in summer without mistaking for a hummingbird one or other of the big hawk-moths that poise on whirring wings before flowers very much after the manner of the bird, which is scarcely larger. These and similar cases are ruled out by some thinkers on the ground that they are not imitations but cases of parallel development. Many kinds of insects imitate the stinging, and therefore dreaded, tribes of bees and wasps, including flies, beetles and so forth. One common American fly (Volucella) «imitates the honey-bee so closely that one would hesitate to handle it even after being told that it is harmless»; and it profits by the deception to lay its eggs inside of hives. Other flies copy bumblebees so closely as to be remarkable, and they imitate their habits as well as their form and colors. «The drone-fly, for example,» says Metcalf, «which imitates a honey-bee, has the same kind of buzzing flight, and when standing occasionally teeters its abdomen up and down, as is characteristic of the bees and wasps. Some of these mimicking flies even protrude and withdraw the tip of the abdomen, as does an angry bee or wasp,» threatening to use a sting it does not possess.

Hints have already been given that scientific men are not agreed on the interpretation of all these phenomena, or the causes of them. An attempted discussion of the many questions involved is not possible here. Those who care to go more deeply into the matter should read the evidences and arguments in the books of such men as A. R. Wallace, H. W. Bates, Thomas Belt, Fritz Müller, S. H. Scudder, Lloyd Morgan, W. Bateson and others. A brief and excellent discussion of the matter will be found in ‘Animal Coloration,’ by F. E. Beddard (London 1892), where many good references to other sources are given.

ERNEST INGERSOLL.

IMITATION OF CHRIST, The. Fontenelle the French philosopher said that the «Imitation of Christ is the most influential book that ever came from the hand of man, the Scriptures having come from the hand of God.» That seems much to say; yet it would be easy to confirm the expression out of the mouths of many of the most distinguished writers and thinkers of the nearly 500 years since the book was written. Lamennais declared that the «Imitation has made more Saints than all the books of controversy. The more one reads, the more one marvels. There is something celestial in the wonderful simplicity of it.» La Harpe the distinguished French dramatist and critic said after reading it in prison «Never before or since have I experienced emotion so violent and yet so unexpectedly sweet.» Nor was it only for Latin minds of preceding centuries that it had such a deep appeal, for in our time it has been the favorite reading of Chinese Gordon, Field Marshall Lord Wolseley, the late Emperor Frederick the Good, and Stanley the Explorer, while the greatest lawyer of our time, Lord Russell of Killowen, always carried a copy of it with him for daily reading.

Saints have praised it highly, for it is a gem in their collection. Saint Francis de Sales declared that «its author is the Holy Spirit.» Saint Ignatius Loyola recommended his Jesuits to read in it every day. Saint Philip Neri called it his «precious treasure.» Bossuet and Massillon, Fenelon and John Wesley, Dr. Johnson and Cardinals Newman and Manning made it their favorite reading. Minds of very different tendency, however, leaders in modern thought with a drift far from conventional Christianity, were quite as emphatic in their expressions. Comte the founder of Positivism wrote, «It is an inextinguishable treasure of true wisdom» and he recommended its daily reading to his disciples. Renan the rationalist was scarcely less fond of it. George Eliot rivalled Lamennais in her praise of it when she said, «It works miracles to this day, turning bitter waters into sweetness.» Matthew Arnold declared it «the most exquisite document after the New Testament of all that the Christian spirit has ever inspired.» Still more surprisingly with his admiration for the ancients, he added, «its moral precepts are equal to the best ever furnished by the great masters of morals, Epictetus or Marcus Aurelius.» The little book that has thus deeply affected the spiritual and intellectual leaders of humanity for almost 500 years was no chance production. It was written, as after long controversy seems now quite certain, in the first half of the 15th century by Thomas á Kempis (1380–1471), a member of the Brotherhood of the Common Life who spent some 70 years in the Monastery of Mount Saint Agnes of that order in the Rhine land. Among the students of the brotherhood were such men as Erasmus, Cardinal Nicholas of Cusa, Agricola, Alexander Hegius and Wimpheling. Thomas á Kempis was the spiritual director of the monastery, and his conferences formed the basis of the Imitation of Christ. He wrote other books but none of the marvelous power of this one.

The original title of the Imitation is said to have been Ecclesiastical Music. Lamartine called it «the poem of the soul.» Its style in the original Latin has a rhythmic quality that makes it easy to understand both designations. There are passages in it like that on love (Book III, Chap. 5) that if read beside a chorus from such a Greek tragedy as 'Antigone,' will stand even this severe comparison in lofty poetic quality. It is undoubtedly the essential poetry of the 'Imitation' that has given the book its permanence. This quality permeates the work and makes every bit of it appeal to the human heart, hence doubtless the tradition that when opened at random the passage that the eye lights upon will always be responsive to the mood of the seeker. It is much more than the work of a great genius in psychology; it is the production of a seer, one who saw more deeply into human nature than is given to any but a very few among mankind. Probably our most satisfactory definition of a poet is that he is a seer, and that the author of the 'Imitation' was to a marvelous degree.

The four books of 'The Imitation' contain (1) Admonitions useful for the spiritual life; (2) Admonitions leading to the interior life; (3) Of interior consolation; (4) A devout exhortation to Holy Communion. It might seem as though the contents then would be too mystical and impractical for men of affairs and of serious intellectual interests, and yet it is to many of these particularly that the book has had its special appeal. Dr. Johnson's favorite expression in it was «If thou canst not make thyself such as thou wouldst be, how canst thou have another to thy liking?» Such aphorisms as «Know that the love of thyself is more hurtful to thee than anything of this world»; or «For all praise patience; but how few are there that desire to suffer?»; or «Faith is required of thee and a guileless life, not loftiness of understanding, nor the depth of the mysteries of God,» taken almost at random from the three latter books are but typical examples of á Kempis' brief sentences which have the precious quality of applying almost directly to whatever a man has in hand at the moment when he opens the 'Imitation.' Consult Cruise, Sir Francis, 'Thomas á Kempis' (London 1887); Kettelwell, 'Thomas á Kempis and The Brothers of the Common Life' (ib. 1882); Scully, 'Life of The Venerable Thomas á Kempis' (ib. 1901); Walsh, J. J., 'The Century of Columbus' (Chapter Latin Literature, New York 1914); Wheatley, 'The Story of the «Imitatio Christi»' (London 1891).

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IMMACULATE CONCEPTION, the privilege by which the Virgin Mary, according to Catholic doctrine, was conceived without original sin. As this doctrine is distinctively Catholic, the following exposition is along the lines of the common teaching of Catholic theologians.

Meaning.— The dogma of the Immaculate Conception of the Mother of God was defined, by Pope Pius IX, 8 Dec. 1854, in the bull *Ineffabilis Deus*. The most important words of this definition are the following:

> In honor of the holy and undivided Trinity, for the splendor and adornment of the Virgin Mother of God, to extol Catholic faith and increase the Christian religion, by the authority of our Lord Jesus Christ, of the blessed Apostles Peter and Paul, and by our own authority, we declare, pronounce and define that the doctrine, which holds that *the most blessed Virgin Mary, from the first moment of her conception*, by a singular grace and privilege of Almighty God, in view of the merits of Jesus Christ, Savior of the human race, *was preserved free from all stain of original sin*, is revealed by God and therefore to be firmly and constantly believed by all the faithful.

In the above definition the word *conception* does not refer to the act of conceiving, but to the term of that act. The body of Mary was formed in the ordinary and natural way. Just so soon as the newly created soul animated her body (probably the primordial cell wherefrom the full formed body was evolved), then and then only could the person be said to be conceived. Now, according to the ordinary course of fallen nature, Mary would at that very moment of her conception have been tainted with original sin. Such is the teaching of Saint Paul: Just as through one man *the sin*,— i.e., original sin,— came into the world, and through *the sin* came death; so death passed unto all men, for that all men sinned. . . . Briefly then, just as through a single downfall the result was (*sic*) condemnation for all men; so, too, through a single decree of justification the result was (*sic*) for all men that justification which meaneth life. For, as, through the disobedience of one man, the whole race was made sinful; so, too, through the obedience of one man, the whole race will be made just. (Romans v, 12, 18, 19). This ordinary course of fallen nature was by a special privilege not the course of Mary's nature. She is «our tainted nature's solitary boast» in that her nature was never tainted, never fallen. The stain of original sin was not *removed* from her soul; it was simply *excluded*. In one and the very same moment, Mary's soul was created, animated her body, and was sanctified by the exclusion of original sin and by the infusion of divine grace. She, who was foreordained to be the Mother of the Christ, was, from the very first instant of her existence as a human person, freed from original sin and filled with grace; and that through no merit of her own, but entirely in view of the merits of Him who was foreordained to be her divine Son, Jesus Christ.

Defense of the Definition.— To the Catholic there is no need of any defense of the definition of the Immaculate Conception. He accepts the Church as his authoritative teacher in matters of faith and morals. She cannot err in handing down the message of him who said:

> «All power hath been given me in heaven and upon earth. Therefore go ye, make disciples of all nations, baptise them in the name of the Father and of the Son and of the Holy Ghost, teach them to observe all things whatsoever I have commanded you. And, lo, I am with you all days, even to the end of the world. (Matthew xxviii, 18–20).

When the Council of Trent, Session V, 17 June 1546, declared that it had no intention to include «the blessed and immaculate Virgin Mary, Mother of God,» in its decree on the universality of the fall of man by Adam's sin, the immediate consequence was still greater motive of credibility of the doctrine of Mary's stainlessness, and still greater increase of Catholic devotion to her privilege of exclusion from Adam's taint. So that the definition of Pius X caused no surprise. For five years his commission had studied the attitude of the whole Catholic world. The Immaculate Conception was found to be believed all the world over. All hoped and prayed for the definition that «the doctrine is revealed by God, and therefore to be firmly and constantly believed by the faithful.» All rejoiced, when the Vicar of Christ, speaking *ex cathedra* as the universal pastor of all the faithful, clearly indicated the defined article of faith. The definition was new; the doctrine was old,— as old as the deposit of faith entrusted to the Church to guard and define. The Church cannot add to this deposit of revelation. Her part is to follow the injunction of Saint Paul: «Guard the glorious deposit, by the help of the Holy Spirit who is within us» (2 Timothy i, 14). She receives no new revelations; but defines and guards the old. In every new definition of an old truth, she fearlessly takes her stand «in defense of the faith that has once for all been entrusted to the keeping of the saints.» (Jude iii).

And yet the dogma of the Immaculate Conception was at least implicitly contained in Holy Writ, and explicitly taught by the Fathers of the Church. To show such content is beyond the range of this brief article. Only the outline of the argument may be indicated.

1. Gen. iii, 14–15, the curse of the serpent may be thus translated from the Hebrew:

> Since this thou hast done,
>   Accursed art thou
> Beyond all beasts and brutes of the wild,
>   All the days of thy life.
> On thy belly shalt thou crawl,
>   Biting the dust.
>
> Enmity shall I set
>   Between thee and the woman,
> Between thy offspring
>   And her offspring.
> They shall smite thy head,
>   Thou shalt smite their heel.

In its *literal* meaning, this curse includes the victory of the woman and her offspring over Satan and his offspring. The woman is Eve; her offspring are all the just,— the physical Christ and the Mystic Christ, or the Church. In its *typical* meaning, the curse includes the complete victory of Mary over Satan. For Eve is the type of Mary. And yet such complete victory would not have been, had Mary ever been tainted with sin,— even with original sin.

2. Luke i, 28:

> Hail, full of grace, the Lord is with thee; blessed art thou among women.

These words of Gabriel's greeting mean such fulness of grace, such intimate union with God, such blessedness beyond all women, as to preclude all taint of sin, even of original sin.

3. The Fathers, who follow such an interpretation of these two passages of Scripture and defend the freedom of Mary from all sin, may be found in any of the works of our bibliography.

4. A fourth reason for the definition of the Immaculate Conception, given by the bull «Ineffabilis Deus,» is the fitness of the privilege unto the Mother of God. The eternal decree of God the Father to save the human race by the merits and satisfactions of the Word incarnate included the choice of a mother to the God-man; and it was most fitting that this mother should be embellished with a superabundance of grace, and that naught of sin should ever tarnish her soul.

Bibliography.— Passaglia, C., ‘De immaculato Deiparæ semper Virginis Conceptu’ (1854); Ullathorne, ‘The Immaculate Conception of the Mother of God’ (1904); Terrien, ‘L'Immaculée Conception’ (1904); Le Bachelet, ‘Dictionnaire Apologetique de la Foi Catholique,’ s. v, «Mariolatrie,» (1917); Kösters, ‘Maria, die unbefleckt Empfangene’ (1905); Mir y Noguera, ‘La Immaculada Concepcion’ (1905).

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IMMANUEL, or **EMMANUEL**, Hebrew name employed by the prophet Isaiah, the signification of which — «God with us» — is not by itself proof that the child to whom it was to be given would be divine. But in Matt. i, 23, it is declared that the name had been divinely applied in a special prophetic manner to the child Jesus. The prophecy itself (Isaiah vii, 14) appears to call for a fulfilment near at hand, and in accordance with the ordinary laws of nature, the mother of the promised child being unmarried at the time the prophet spoke. The birth of such a child in fulfilment of a special promise might be a sufficient sign for a deliverance from national calamity. But as the whole prophecy of Isaiah has supreme reference to a spiritual salvation (some modern scholars to the contrary notwithstanding), the sign of the lower deliverance may have also an ultimate application to the higher; a woman unmarried pointing forward to the virgin mother, and an ordinary child taken as a prophetic emblem of the child Jesus miraculously conceived and born. That this is the true interpretation is argued from (1) the New Testament account of the Nativity, the inspired authority of which is established by independent evidence; (2) by the Scripture exhibition of the character and works of Jesus in attestation of His claim to be the Deliverer and Savior who had been foretold as to be sent forth from God. Consult McFadyen, John Edgar, ‘The Book of the Prophecies of Isaiah’ (New York 1912).

IMMENSEE. This touching little story by Theodor Storm was first published in 1850 and brought its author general recognition. In a quiet hour at twilight an old man, called Reinhardt, sees his life — as far as Elizabeth, the playmate of his youth, is connected with it — pass before his inner eye. He sees the happy scenes of their childhood, the light and shade of his student days stand out before him, he recalls his one and only visit to her, after she had married a friend of his. A mood of resignation gradually pervades his recollections, for he and Elizabeth had loved each other, and yet they had not been united.— ‘Immensee’ is typical of Storm's early prose tales. It strikes the key of resignation, that resignation which consists on the one hand in an insuperable longing for happiness, on the other hand in that purity and quiet which distinguish men who, free from all bitterness, look at life with the realization that their innermost desires can never be satisfied and seek refuge in the recollection of more promising days of the past. The story is told in a series of only vaguely connected "situations" which are to set forth such poetry as may be contained in every-day life and the lyric atmosphere of which crytallizes at certain points into finished poems. Consult edition of Theodor Storm's Works (Vol. I, pp. 1–38, G. Westermann, Braunschweig); Schütze, P., ‘Theodor Storm’ (2d ed., 1907, pp. 100–109); Schmidt, Erich, ‘Charakteristiken’ (Vol. I, 2d ed., 1902, ‘Theodor Storm,’ pp. 404–408).

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IMMERMANN, Karl Leberecht, German dramatist and satiric novelist: b. Magdeburg, 24 April 1794; d. Düsseldorf, 25 Aug. 1840. His parents were the *Kriegsrat* Gottlieb L. Immermann and Friederike Wilhelmine, née Wilda. The family was purely Prussian and nationalistic in its convictions, which induced a patriotic fervor in Immermann that was to last for some time. He studied law at Halle (1813–17), but his course was interrupted by his participation in the wars of liberation, and a resulting illness, which prevented him from facing the enemy until the battles of Ligny and Waterloo. In Düsseldorf Immermann helped to found a Theaterverein (1832) and conducted model performances and lectures on dramatic art until 1837. As a poet, Immermann may be considered as a transition from romanticism to realism; he regarded himself now as a follower of Goethe and Tieck, now as a member of the Jung Deutschland movement. His two most famous works are novels of contemporary life, ‘Die Epigonen’ (‘family memoirs,’ Düsseldorf 1836), and ‘Münchhausen, eine Geschichte in Arabesken’ (Düsseldorf 1838–39), in which latter he attempts to satirize the unnatural cynicism of the upper and middle classes of his day, in contrast to which he inserts the country tale ‘Oberhof’ into the work, which is of all his productions the only one to achieve lasting popularity. His historical plays are ‘Ein Trauerspiel in Tirol’ (1827, later known as ‘Andreas Hofer’), ‘Kaiser Friedrich II’ (1828), ‘Alexis’ (trilogy from Russian history, 1832). ‘Memorabilien’ (1840–43), ‘Theaterbriefe’ (1851), give his views of literary and dramatic art. See Münchhausen.

IMMERSION. See Baptism.

IMMIGRATION. Immigration into the United States viewed historically is but a continuation of the movement of peoples from the far east into southeastern Europe, then into Europe proper, and finally over seas to the two Americas and Australasia. Peoples, races and groups have been in movement as far back as history records; they have drifted from place to place as the result of wars, conquests, famines, the opening up of new lands, and the changing of climatic and economic conditions. The wandering of the peoples following the incursion of the barbarians into Italy was an immigration movement. It differed from immigration to-day in that the wandering of tribes was a movement of races rather than of individuals and families.

Early Immigration to America.—Immigration to America differs from the migrations of early peoples in that it is a movement of families and individuals rather than of nations, races and clans. It has been so from the very beginning. And the character of American immigration has changed with changing conditions in Europe on the one hand, and the changing industrial and economic conditions in America on the other. The first immigrants to New England were driven to this country by religious intolerance. They made the first settlement. And the early settlers in New England, inspired as they were by religious motives, have profoundly affected the subsequent migrations of the same people out of New England to the middle and the far West. We can trace the ethical influences of early Puritanism as far west as California; and individuals and groups made their way to Ohio, Iowa and even distant California.

But the primary motive of immigration to America is not religious. Only a handful of immigrants have been driven to this country in the search for either religious or political freedom. The overwhelming majority of immigrants have come to this country as a result of economic forces; economic forces at work in Europe, or the greater economic opportunities which America afforded. This is almost exclusively true of all immigration since the 17th century.

For nearly three centuries the immigration to America was almost exclusively from the British Isles, Germany and Scandinavia. There were Swedish settlements in New York and Delaware; Dutch settlements in New York; south German settlements in Pennsylvania and the South. But the great bulk of immigration up to very recent years has come from Great Britain and Ireland, the Scandinavian countries and Germany. The migration from Germany was particularly strong from the revolutions of 1848 down to shortly after the Franco-Prussian War. There has been but little French immigration to America, and relatively few immigrants from Switzerland and Holland.

This is the "old immigration," so called. This is the immigration that gave America its Anglo-Saxon quality. It was unmixed with Latin, Slavic or Oriental peoples. From the very beginning it was a peasant immigration. It came in search of a new home in a country where free land could be had for the asking. And it built an agricultural civilization. For two centuries and a half civilization of the United States was predominantly agricultural, just as it was predominantly Anglo-Saxon. The incoming waves of immigrants moved west just beyond the line of settlement. They picked up small farms of from 30 to 60 acres; only such farms as an individual could himself cultivate. Each oncoming generation moved westward, settling New York, Ohio, Indiana, Kentucky, Tennessee. Illinois, Michigan and Wisconsin. Only a small portion of the immigrants settled in the towns or cities. Up to the Civil War, and even as late as 1880, our immigration was not only predominantly of Anglo-Saxon, Scandinavian and Germanic stock, it was also predominantly agricultural.

During the three decades which followed the Civil War the American West was rapidly peopled. Kansas, Nebraska, Texas and the northwest were taken up by homesteads, or were divided into great estates as a result of the Pacific railway aid grants. In a few years' time western America was appropriated, and by the end of the last century the public domain and practically all of the free land in America had been appropriated. All over the West, even in California, Oregon and Washington, great stretches of land were held by the railroads, divided into great timber or grazing preserves, and by 1890 the possibility of absorbing immigration on the land, which had existed for three centuries, had come substantially to an end.

Changing Immigration.— This marks the end of the first great epoch in American life. This definitely altered the source from which immigration came, as well as the economic conditions of America. The "old immigration" was a home-seeking, land-owning, agricultural immigration. It was primarily Anglo-Saxon, and primarily agricultural as well. The "new immigration," so called, comes from south and central Europe. It was primarily agricultural at home; it became almost exclusively industrial in America. It came in response to economic conditions in this country, just as had the earlier immigration from the north. But the suction which drew the new immigration was high wages in the rapidly expanding industrial and mining centres of the East. It did not go to the land; not because it was unwilling to, but because the land was all gone. It was compelled to go to the cities and mining camps, where it congregates in race groups and settlements and remains more or less segregated from American life and institutions. The new immigration created the immigration problem and the movement for restriction, which was traceable to several things:

1. Race hostility and the protest of those descended from Anglo-Saxon and Teuton stock to the rapid increase of Italian, Slavic and Oriental peoples.

2. Religious protest against the large Catholic infusion from central and southern Europe.

3. Economic protest from American labor against the competition of cheap European labor willing to accept — temporarily at least — a lower standard of living than that to which American labor was accustomed.

Immigration Legislation.— The passing of free land, the economic pressure of vast numbers of unorganized workers, together with racial and religious influences, led to a movement for the restriction of immigration. Other forces contributed. Mine owners, contractors and employers in the United States sent agents to Europe who brought in great bodies of men who broke strikes or destroyed the solidarity of labor; the steamship companies stimulated immigration; while European countries dumped undesirables of all kinds on America. But the most powerful forces behind the movement for the restriction of immigration were economic and racial.

Early restrictive legislation was not in fact restrictive. It was selective. No attempt was made to limit the number of people who could come to this country; the attempt was to bar out those who were considered undesirable because of economic, moral or political reasons. During the fiscal year ending 30 June 1914, 33,041 persons were debarred as feebleminded, tuberculous, afflicted with loathsome contagious disease; as beggars, paupers or likely to become a public charge; as contract laborers, criminals, polygamists, anarchists, prostitutes and those coming for an immoral purpose; or for other reasons. Of this number the great majority were excluded on economic grounds: 15,784 being excluded as paupers or likely to become a public charge; 4,531 as imbeciles or afflicted with some disease; 2,793 as contract laborers; 755 as criminals; 31 as polygamists; 1 anarchist; 385 prostitutes; 354 for attempting to bring in prostitutes or females for an immoral purpose, and 322 under the provisions of the Chinese Exclusion Act. There were 6,537 excluded under surgeons' certificates for defective mentality or physical unfitness to earn a living. The excluded and debarred persons in 1914 constituted 2 per cent of the total immigration for the year.

Restrictive Legislation.— On 1 May 1917 a new law went into effect, passed 5 Feb. 1917, whose avowed purpose was to limit immigration. It was avowedly directed against immigration from southern, central and eastern Europe. Immigration was to be limited by the "literacy test," which excluded all aliens "over 16 years of age, physically capable of reading, who cannot read the English language or some other language or dialect, including Hebrew or Yiddish." There are many exceptions to the literacy test which permit the admission of otherwise inadmissible aliens, such as a father or grandfather over 55 years of age, wife, mother, grandmother, unmarried or widowed daughter, and children under 16 years of age. The law also mandatorily excludes immigrants from a great part of Asia. In addition the head tax was increased from $4 to $8.

Old and New Immigration.— Up to about 1890, as stated above, the bulk of the immigration to the United States came from northern Europe. Since that time immigration has been predominantly from southern and central Europe. In 1914, in which fiscal year the total number of immigrant aliens numbered 1,218,480, the races and principal countries of Europe and Asia contributing to our immigration were the following:

Italians (South)	251,612
Italians (North)	44,802
Hebrews	138,051
Polish	122,657
Crotians and Slovenians	37,284
Lithuanians	21,584
Magyars	44,538
Roumanians	24,070
Russians	44,957
Ruthenians	36,727
Slovaks	25,819
Spaniards	11,064
Syrians	9,023
Bohemians	9,928
Armenians	7,785
Bulgarians, Servians and Montenegrins	15,084
Greeks	45,881
Total	890,669

Immigration from the races of northern Europe was as follows:

Dutch and Flemish	12,566
English	51,746
Finnish	12,805
French	18,166
German	79,871
Irish	33,898
Scandinavian	36,053
Scotch	18,997
Welsh	2,558
Total	266,660

At the outbreak of the European War there were nearly 15,000,000 persons of foreign birth in the United States. Of these the great majority were of the new immigration from southern and central Europe. And they were almost exclusively engaged in industry, and especially in the unskilled trades. The new immigration, too, is largely urban. It settled in the great industrial cities and in the mining regions. The population of New York, Cleveland, Chicago, Boston and other industrial centres, is from 73 per cent to 78 per cent of persons of foreign birth or those immediately descended from persons of foreign birth.

Illiteracy is very high in the countries from which the new immigration of recent years has come. Illiteracy of the population over 10 years of age is in Bulgaria, 65.5 per cent; Greece, 57.2 per cent; Hungary, 33.3 per cent; Italy, 37 per cent; Roumania, 60 per cent; Russia, 69 per cent; Servia, 78.9 per cent; Spain, 58.7 per cent. On the other hand illiteracy in Denmark falls to .2 per cent; in England and Wales, 1.8 per cent; Germany, .05 per cent; Sweden, .2 per cent; Switzerland, .3 per cent. The new immigration law will automatically exclude immigration from those countries of southern and central Europe from which immigration in recent years has been particularly heavy.

Immigration and the War.— The European War has suspended immigration. Whereas immigration in the years immediately preceding the war rose to the high-water mark of an average of 1,200,000 annually, since the outbreak of the war it has steadily diminished in numbers. The total volume has been as follows: In 1915, 326,700; 1916, 298,826; 1917, 295,403. This immigration has come almost exclusively from the Scandinavian countries, from Italy, Greece, Spain, Portugal and from the other non-belligerent countries of Europe, and from Mexico.

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IMMIGRATION, Bureau of, a sub-section of the Department of Labor, charged with the administration of the Immigration Laws. The bureau is directed by a commissioner-general whose annual salary is $5,000. See UNITED STATES — IMMIGRATION.

IMMIGRATIONS, Animal and Vegetal, into America began in early geological times. At the dawn of the Age of Mammals, when the great Mesozoic reptiles were disappearing, and the Tertiary Era introduced the dominance of mammalian and other types of animal life, that became more and more modernized as time advanced, the circumpolar regions of the Northern Hemisphere seem to have been a continuous mass of land. The climate was mild, and animals and plants had free space in which to wander right around the northern world. The origins of the strange primitive creatures then prevalent are unknown; but their scanty fossil remains show their substantial identity in Europe, Asia and America. Before long — as geological time is reckoned — changes in the restless crust of the earth caused separation of North America from both Asia on the west and Europe on the east, and fossils of the Middle Eocene show that local types speedily developed in every continent. This independent and divergent adaptive modification continued until the Eocene had merged into the Oligocene, as shown by rocks of the White River formation in eastern Wyoming. Land connection had been restored by a lifting of the Bering Sea region, and an isthmus thus formed between Alaska and Siberia. By this bridge came new forms from Asia, while American migrants wandered into the Old World; but the interchange was very limited, bringing to us only certain small forerunners of the sabre-toothed «cats,» of the mustelines of some early creodonts (as *Hyænodon*), and of primitive rodents. At this time were introduced also the anthracotheres, short-legged, somewhat swine-like, hoofed animals, which have no near relatives in the modern world, but had been previously well represented in Europe. There came also the earliest of the horses (*Eohippus*), the first opossums and a few others. The Oligocene was followed by the Miocene, a period of mild climate and wide-spread volcanic activity, in which land connection with Siberia, long interrupted, appears to have been restored, and when the first small forms of proboscidians entered this continent, on which subsequently they developed so extensively. «The place of origin and ancestry of these animals,» says Prof. W. B. Scott, «were long exasperating puzzles. Appearing suddenly in the Miocene of Europe and North America, in which regions nothing was known that could, with any plausibility, be regarded as ancestral to them, they might as well have dropped from the moon for all that could be told respecting their history. The exploration of Eocene and Oligocene beds of Egypt has dispelled the mystery, and shown that Africa was the original home of the group.» Pliocene time witnessed important introductions from both Asia and South America, where an independent fauna was developing. The most striking novelty, probably, were the bears — a distinctly Old World family. Among the notable importations in the next, or Pleistocene, period, were the antelopes and the bisons. These instances of animal invasion in the distant past are only a few of the list that might be compiled were palæontologists as certain of the foreign origin of some groups as they are of others. More important to us than this, however, is consideration of the invasions of animals and plants within historic times. Horses, cattle, sheep, dogs, cats and poultry, were brought in by the conquerors of tropical America, and by the colonists of its northern coasts, and these aids to agriculture, hunting and housekeeping were too quickly followed by invading foreigners of a harmful character. In the same way grain-plants, forage-plants, garden vegetables, fruits and ornamental trees, shrubs and flowers, came into the country from all parts of the world. Some, unsuited to the conditions, died out; or, like tea and indigo, proved unprofitable and have been neglected. With the ships that brought these beneficent additions to our fauna and flora came many unwelcome visitors — true invaders in the modern sense of the word. Weeds innumerable began with the first settlements. Most of them were accidental importations, in seed, or in the discharged ballast of ships, or were attached to trees, shrubs and plants imported. Some were garden-flowers, controllable and harmless at home, but here flourishing inordinately and spreading into fields and highways; others, weeds and grasses pestiferous everywhere; others the molds, smuts and similar bacteric or fungoid diseases afflicting grains and fruits. It was long before the government took any precautions against such evils.

Simultaneously, and in a similarly careless way, various animals gained entrance and became pests, among them innumerable injurious insects. One of the most noticeable of the early invaders of this kind was the Hessian fly. The famous gypsy moth began here with escapes from an entomologist's collection near Boston in 1869. Among higher animals the house-mouse and black rat came across the Atlantic in early days, the brown rat previous to the Revolution, and these have become troublesome and even dangerous everywhere. (See Rat). Later, unwise persons imported the European ho se sparrow («English» sparrow), about 1851. A few years later the skylark, European goldfinch and some other birds were introduced, but fortunately have not become naturalized. Starlings were set free in New York city in 1890, bred abundantly and threaten to become a costly nuisance. Rabbits are common in domestication, but by good fortune have not colonized wild, as has happened so disastrously in Australia. Lapp reindeer have been colonized in Alaska to the great advantage of the Eskimos there.

A few years ago the United States government, warned by naturalists, began to realize the danger in further invasions of this kind, and laws were passed requiring inspection of every plant and animal brought into the country, to make sure that some new and harmful insect or disease did not come with them; and prohibitions were made against the importations of foreign animals, especially certain dreaded ones, as the mungoos. These precautions are in the hands of the Department of Agriculture, and have been highly beneficial in their purpose and effect.

It was formerly believed that human invasions had taken place in prehistoric times on a large scale. Some of the theories, as of arrival of peoples from Egypt, or India, or Polynesia, or Japan, were highly fanciful; but more reasonable was the belief that this continent was populated by the invasion, thousands of years ago, of immigrants from Asia bv way of Siberia and Alaska. It is not to be denied that something of the sort may have taken place in the very remote past on an extended scale, but there is no direct evidence of it, either then or more recently.

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Ernest Ingersoll.

IMMISCH, im'ish, Otto, German classical scholar: b. Wartha, Lusatia, 1862. He received his education at the University of Leipzig, was appointed lecturer there in 1889 and professor in 1896. From 1907 to 1913 he was professor at Giessen and in the latter year was appointed to a chair at Königsberg. He published 'Philologische Studien zu Plato' (1896; 1903); 'Die innere Entwicklung des griechischen Epos' (1904); an edition of Susemihl's 'Aristotelis Politica' (1909); 'Wie studiert man klassische Philologie?' (1909); 'Das Erbe des Alten' (1911).

IMMORALITY, in general, a course of conduct at variance with the accepted standards of a community, and more especially those of a sexual character. Until recent times the law except in a few instances took no cognizance of immoral acts which in their consequences affect only the immediate participants, but the present tendency everywhere appears to be the extension of the law to regulate the private lives of persons, subjecting at the same time all offenders to legal penalties. See Adultery; Drunkenness; Fornication; Gambling.

IMMORTALITY (Lat. *immortalitas, in* + *mortalis,* «not mortal»). The doctrine that the soul continues to exist after death, or more specifically the doctrine of eternal personal survival. To the question «What becomes of the soul after death»? various answers have been given by different philosophers and civilizations. The most noteworthy of these answers may be grouped as follows: (1) Complete annihilation (the Materialists); (2) Survival of the soul for an indefinite period in a world of filmy shadows (Aboriginal); (3) Eternal existence in a moral world of retribution (Christian and certain idealistic philosophies); (4) Transmigration (Indic, as early as the Upanishads; the Egyptians, Plato, the Pythagoreans, and sporadic amongst aborigines); (5) Absorption into an Infinite or Absolute Being (Pantheism; the Buddhistic Nirvana, where the individual is annihilated only in the sense that the seed is annihilated in the fully developed plant,— the seed's life-goal); (6) The survival of the individual in the form of the posthumous influence of his personality and achievement, which is scarcely more than a metaphorical use of the term Immortality (many Evolutionists and Positivists; cf. also Ostwald, Münsterberg); (7) Merging or diffusion of the psychic energy of the individual into an unseen hypothetical etheric energy (quasi-materialistic).

Belief in some form of immortality is widespread, although not universal. It is found in all stages of civilization from the lowest form of aboriginal life to the highest Occidental culture. The doctrine varies from a belief in an indefinite survival-period after death to the belief in eternal personal life, the latter being the legitimate use of the term Immortality.

Aboriginal Civilization.— Amongst primitive peoples, belief in the survival of the soul is due mainly to four things: (1) Their prevailing animism, which ascribes a soul to everything; (2) The phenomena of dreams and apparitions; (3) The instinctive will to survive and the instinctive aversion to annihilation; (4) The belief in the substantial character of the soul as an entity. «Looking at the religion of the lower races as a whole, we shall at least not be ill-advised in taking as one of its general and principal elements the doctrine of the soul's future life.» (Tylor, 'Primitive Culture,' Vol. II, p. 19). By «future life» is not meant immortality in the strict sense, but simply the soul's survival after death. Amongst aboriginal peoples we find two forms of the doctrine: Transmigration and the independent personal existence of the soul. It must be noted, however, that the dominant idea in the lowest civilization is simply the continuance of the soul in a new life similar to the present life. The abode of souls is usually in some distant part of the earth, less frequently in the nether world or the sky (some Hindus represent the seat of happiness to be vast mountains on the north of India), where they pursue a life modeled after this life, without ethical coloring. To some aborigines the idea of a bodiless existence is unintelligible or ludicrous (cf. Lubbock, 'Origin of Civilization,' 5th ed. p. 378). In the Tonga Islands, the chiefs are thought to be immortal, while the common people are held to be mortal. Amongst the Fijians the belief prevails that everything has a spirit, and they even hope that every coconut will be made anew in Paradise. (Peschel, 'The Races of Man,' 2d ed., p. 259). They do not restrict future life to man or even to animals. So also the Itelmes of Kamschatka believe in the rebirth of all creatures «down to the smallest fly.» (Peschel, *op. cit.* p. 259). The Fijians think that as is their condition at death, so will their condition in the next world be. The infirm and diseased will find it difficult to make the long journey to Mbulu; consequently it is a custom to put the aged to death before they become too weak to travel. A common belief amongst some primitive peoples is that the individual has several souls, as amongst the Chippewa Indians, the Khonds of Hindustan, and in Madagascar. The Sioux Indians believe that man has four souls, as has also the bear (in their view the most human of animals). The Totemism of the Indians rests on the theory that the souls of ancestors have passed into the bodies of animals. Certain Eskimos put a dog's head in a child's grave, because the dog is skilful in finding its way and can guide the child's soul to the spirit-land. (Tylor, *op. cit.* p. 424). The Hottentots place the body of the deceased in the same position as the embryo occupied in the mother's womb, symbolizing thereby their belief that in the womb of the earth's darkness the dead will mature and come to birth. The lower races, in general, regard the soul as a filmy body, i.e., a corporeal entity capable of life and action, and needing, consequently, no bodily renewal. The idea of a resurrection of the body is, however, often found amongst primitive peoples, although it forms no important feature of their belief, as it does in the doctrine of immortality in Persia, later Judaism and the Pauline Epistles. On the whole, one may say that the difference between the conception of lower races and that of higher civilizations regarding the immortality of the soul is that the former look upon the future life as a continuance of the present type of sense-life, with activities analogous to the present crass activities, a corporeally refined shadowy state, with a decrease in the struggle for existence and an increase in the amount of pleasure. The higher civilizations, on the other hand, make the doctrine of judgment and retribution paramount, spiritualize the conception of the soul and its future life, eliminate geographical definiteness from the soul's abode and correlate the conception of immortality with a system of religion and ethics.

The Egyptians.— In the earliest known civilization of Egypt, the problems of religion and eschatology were central interests. In the remotest period of their history, the Egyptians believed in an invisible deity or deities and in the future life of the soul. The human soul is of the divine substance, an emanation from Ammon-Ra. At death it passes to the seat of judgment at the gateway of Amenti (the Hellenic Hades) and there it is adjudged by the 42 assessors (representing the 42 sins of which the soul must be innocent) of the dead, before the supreme tribunal of Osiris. The soul that is proved pure at the judgment returns to its divine origin, while the soul that has led an impure life is condemned to reincarnation and passes into an animal life to attain purification through probationary metempsychosis. The theory of the future life of the soul amongst the Egyptians is based on the metaphysical view that the soul is an emanation from an original cosmic soul, on the ethical view that the present life is a probationary period, and on the conception of the moral fitness of the soul for reabsorption into its original source, the sun-god Ra — the head-spring of all light and life. See Book of the Dead.

Hebrews.— Sheol, or the realm of shadows, appears in the early history of the Jews to be an amplification of the idea of the grave, as the dark abode of departed spirits, where souls dwell bodiless, unconscious, without feeling. The references in the early part of the Old Testament Scriptures to a future life are rare and vague, and the doctrine of the immortality of the soul is nowhere explicitly taught in the early books. The rites of necromancy were discouraged by the prophets and lawgivers of ancient Israel as antagonistic to belief in the God of life, whose realm excluded Sheol (or the realm of the dead), until post-exilic times. Eternal life belongs to God alone, and to those celestial beings who have eaten of the tree of life and live forever. In connection with the Messianic hope and under the influence of Greek and Persian ideas, the later Jews adopted a doctrine of resurrection of the body which made room for belief in the soul's continuous life. The Cabalists took up the doctrine of transmigration (Gilgul, «rolling on» of souls) according to which the soul of Adam passed into David and shall pass into the Messiah, as is mystically set forth in the letters of that name (Ad[a]m). The Platonic doctrine of preexistence is also found in the rabbinical philosophy. Immortality conjoined with the dogma of the resurrection is the prevailing conception in the post-exilic literature, the latter (resurrection) becoming fixed in the Mishna and liturgy. Since the time of Moses Mendelssohn, who rehabilitated the doctrine of Plato in his 'Phædon,' progressive Judaism tends to lay less emphasis on the resurrection of the body, and greater emphasis on a purely spiritual immortality, the former dogma being discarded in the Reform rituals.

The Greeks.— The origin of the doctrine of immortality amongst the Greeks is lost in the remotest antiquity. It is found in the early traditions of the Orphic and Dionysiac mysteries, in the poems of Homer and Hesiod, and forms a central tenet in the philosophy of Pythagoras, a contemporary of Buddha-Siddhattha and Lao-Tze. The view of Pythagoras includes the doctrine of transmigration, which may have been suggested to him by the theology of the Orphic mysteries or by Pherecydes, rather than by the Egyptians (Zeller, 'Pre-Socratic Philosophy,' Vol. I, pp. 71, 514). The great problem of a man's life is moral purification, which he pursues in a divinely governed Cosmos, where his chief end is to become like God. The soul is imprisoned in the body because of sins committed in a pre-existent state, and after death passes into a superior or inferior state, according as it has served Good or Evil. In the ascending stages of metempsychosis the soul is prepared for moral redemption. Although the belief in some form of immortality prevailed amongst the Greeks throughout their history, and probably came into their philosophy from their religion, it was not until Plato that a philosophic basis was furnished to the doctrine. The Platonic arguments for the immortality of the soul may be summarily stated as follows: (1) The fact that the mind brings to the study of truth a body of interpretative principles and axioms with it, as part of its native endowment, shows that they can be only reminiscential and, therefore, derived from a pre-existent state; (2) The soul is an ultimate unity (i.e., monadic in character) and, therefore, not being composite or divisible, it cannot be disintegrated; (3) The soul (ψυχή) means the "principle of life," having the idea of life essentially immanent in it, and inseparable from it, and therefore it must exclude the opposite idea, death; (4) The soul is self-moving, deriving its activity from within; consequently its motion and therewith, its life, must be perpetual; (5) The soul as an immaterial reality is essentially related to the immaterial, invisible, eternal idea; and as the former is akin to the latter in nature, so is it also akin in duration; (6) The superior dignity and value of the soul argue for its survival of the crass body, and even the crass body persists for a time; (7) The cyclical movement of nature shows everywhere the maintenance of life by opposition, as night, day; sleeping, waking; the dying seed, the germinating flower. This is an argument from analogy: out of the decay and death of one living organism, a new life is generated; (8) The instinctive aspiration of the soul toward a future existence shows that the belief is founded in natural law; (9) Things that are destructible are destroyed by their peculiar evil or disease; the peculiar evil of the soul is vice, which corrupts the soul's nature, but does not destroy its existence; (10) The world as a moral and rational world demands a future life of rewards and punishments for the rectification of inequalities in this life, else the wrong would ultimately triumph, as in a bad play. This argument is based on the ethical claim that there must be a final equivalence between inner worth and external condition or reward. The views of the Greeks, and especially the views of Plato, have had a profound, an incalculable influence on Christian thought, on early theological formulæ and on the sum of Occidental philosophy. Plato was not merely a framer of philosophy, an intellectual interpreter of reality, but still more a man of religion, a seer.

The question of the pre-existence or survival of the soul is not a scientific problem. Positive science is impotent either to prove or disprove the dogma. It is a problem for religion, and its ultimate appeal is to faith. So long as science keeps within its borders, it is neither philosophy nor religion, and has no verdict to pronounce upon ultimate reality. The dogma of immortality in the higher civilizations is largely based on the philosophical theory of the ideality of human life, and on the demand for an ideal completion of experience which involves a transexperiential world. It is a postulate of purposiveness, of teleology in the ethical realm.

The general tendency of modern biological science and cerebral physiology has been to discard the doctrine of immortality, although the relations between molecular movements of the brain, on the one hand, and thoughts and feelings, on the other, are known to science merely as concomitants, and in no case as products or effects. James ('Human Immortality,' 1898) has endeavored to "draw the fangs of cerebralistic materialism" by ascribing to the brain a "transmissive" function, instead of a "productive" function. Tait and Stewart ('The Unseen Universe,' London 1894) postulate an unseen world, from which the known visible world has arisen and to which we must resort for the origin of molecules as well as for an explanation of the forces that animate these molecules; and it is reasonable to suppose, as these physicists say, that the ultimate unseen universe is connected by bonds of energy with the visible universe and is capable of receiving energy from it and of transforming the energy thus received. To say that the visible world is either eternal or has the power of originating life contradicts the result of observation and experiment (*op. cit.* p. 246). Therefore, the hypothesis of an eternal unseen universe is necessary to explain the evolution of the matter and life of the visible world and the only method of avoiding a break in the continuity of reality. The law of the conservation of mass and of energy, the law of biogenesis (every living being presupposes an antecedent life), and the law of continuity (there is no break in reality, the universe is of a piece) make the assumption of an unseen universe the easiest mode of explaining the empirical. Further, the postulate of a rational cosmic energy is necessitated by the ordered character and inherent teleology of reality. The law of continuity and conservation of energy necessitate the further conclusion that the psychic energy of the individual is not lost, but transmuted into the unseen world.

During the 18th century and the early part of the 19th, the dogma of immortality was widely discussed. The French materialists denied the doctrine in every form, regarding the psychic life purely as an organic function. In the system of Identity (Schelling) and Spinozism no place for the doctrine is found. In Fichte's idealism the creative Ego is not the individual, but the absolute Ego; the individual Ego realizes itself only by negating its individuality, by universalizing itself, and the Ego thus exemplifying the conceptual life of truth, continues to all eternity, as an indestructible part of the reality of the Absolute Ego. Hegel paid little attention to the problem, but the early Hegelians split into two factions, the one affirming and the other denying the doctrine (cf. Feuerbach, Richter, Weisse, Göschel, Conradi). In Lotze's teleological idealism the immortality of the soul (which is hardly more than casually mentioned) is based on the principle of value; that thing will continue forever which by reason of its excellence should be an abiding constitutive part of the Cosmical Order, but one cannot say that all human souls are immortal. This idea of a conditional immortality, determined by ethical value, reappears in later discussions (cf. McConnell, 'The Evolution of Immortality'), i.e., immortality is simply a moral achievement.

According to Kant, scientific demonstration is not applicable to these three truths: the Existence of God, the Freedom of the Will and Immortality. They are postulates of morality. The work of man as a moral being, with infinite potentialities, i.e. infinite perfectibility, necessitates an infinite time for their realization. The laws of the moral life are drawn from a transcendental sphere, free from conditions of time and space, and so the very essence of man's moral being is invested with the eternal. Man is infinitely progressive and perfectible in his moral and intellectual evolution, and this fact points indubitably to a further existence. If death were the end, the moral ideal would be illusory, and man would perish a fragment. An infinite moral imperative implies an infinite moral ability. Duty demands moral perfection. Further, the moral ideal is a character-ideal, an ideal of personal aim, which implies a personal destiny, and the non-illusoriness of the moral life implies the possibility of realizing its ideal.

One may fairly say that since the time of Kant the dominant note in the discussion of immortality has been ethical. The main postulates on which faith in the dogma has been based in the late literature of the subject are the moral perfection of a World-Governor, the basic rationality of the universe, and the worth of human life (cf. Gordon, 'Immortality and the New Theodicy,' p. 46).

The advocates of psychical research claim to find in spiritistic phenomena a proof not only for the existence of disembodied spirits, but also for their power to communicate with spirits still incarnate. The examination of these phenomena, however, is as yet in an unsatisfactory stage, and in any case the phenomena, so far as we know, have no bearing on the problem of the duration of survival.

The chief traditional arguments adduced in support of the doctrine are: (1) The ontological argument, which bases immortality on the immateriality, simplicity and irreducibility of the soul-substance; (2) The teleological argument, which employs the concept of man's destiny and function, his disposition to free himself more and more from the conditions of time and space, and to develop completely his intellectual and moral potentialities, which development is impossible under the conditions of earthly life; (3) The theological argument; the wisdom and justice of God guarantee the self-realization of personal beings whom he has created; (4) The moral argument, i.e., the moral demand for the ultimate equivalence of personal deserts and rewards, which equivalence is not found in this life; (5) The historical argument; the fact that the belief is widespread and ancient, showing it to be deep-seated in human nature, and the historical fact of the resurrection of Christ and the statements of the New Testament Scriptures.

As to the attitude of men in the present time toward the doctrine, Osler ('Science and Immortality') happily groups them into three parties: (1) The Gallionians (cf. Acts of the Apostles, xviii, 14), i.e., the Scientists who study the How of the universe and who regard the dogma as without the pale of science, neither affirming nor denying its truth, although tending to reject it; (2) The Teresians (Saint Teresa, 1516–82), i.e., the seekers of the Why of the universe, the mystics who "live by faith" and have the "will to believe," who read a purpose in human destiny and teleology in the world; these are of the spirit of Plato; (3) The Laodiceans, who study neither the How nor the Why of the universe, who are absorbed in empirical problems and the sense-life; these have no practical concern with the doctrine.

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IMMORTELLE. See Everlasting Flowers.

IMMUNITY. It has been a common observation that certain individuals are prone to the infectious diseases, and others not. Some children in a family always «take things hard,» while others are not susceptible. This resistance to the poisons of the infectious diseases, or to the bacteria that cause the poisoning, is termed immunity. It is a relative quality of living matter, and is not confined to man alone, for lower animals, and even plants, show marked variations in their reactions to chemical and organic poisons. Thus certain plants are capable of growing in soils impregnated with metallic poisons of sufficient strength to destroy animal life; many animals are immune to poisons that would kill man; thus birds are comparatively immune to strychnine; young children can take comparatively larger doses of belladonna than adults; the diseases of plants are almost unknown among animals, and vice-versa; certain diseases affect the lower animals and are rare or unknown in humans, and the reverse condition also holds true; thus swine-plague is comparatively unknown in other animals than pigs, and such human diseases as typhoid fever and cholera are not common in lower animals; thus plants, lower animals and man, individually and collectively, enjoy certain relative immunity from destruction when exposed, under ordinary circumstances, to disease-producing agencies.

Natural immunity may be so modified as to be lost entirely, certain forms of disease predisposing the sufferer to ready secondary infection, as, for instance, is seen when tuberculosis follows measles; or a partial immunity be made more effective, or a new immunity conferred. This has been termed acquired immunity. The evolutionary doctrine would tend to interpret natural immunity as an inherited acquired immunity. In the case of man immunity sums up those powers of resistance which the body naturally possesses, or which it acquires in the struggle with infectious diseases, both in endeavoring to destroy the bacteria — bacteriolytic power — and to counteract the toxics — antitoxic power. Modern pathology has shown that the battle-field is a large one, and that the opposing forces are numerous and their powers largely unknown; and it must be remembered that the struggle has been going on for millions of years.

The observation that certain diseases — as measles, scarlet fever, smallpox — once acquired, confer a marked immunity, led up to vaccination, this inoculation against smallpox being the first conquest of disease by such means. It is certain that others will follow. Certain diseases — notably pneumonia, influenza, erysipelas — confer an immunity, but it is not lasting; thus demonstrating the principles of variability in the «immune bodies» as a class, and of an active and a passive immunity which may be conferred by various means, an active immunity being acquired by the animal for itself by direct adaptation, a passive immunity being conferred by a body made in the blood-serum of another animal.

Former theories for explaining the varied picture in this rapidly widening study have been numerous. They may be classed under the *exhaustion theory* of Pasteur, which assumed that the bacteria used up the available food-supply and died; or, as the laity often express it, «the disease wore itself out.» This theory has been thoroughly disproved. The *retention theory* — that the bacteria are killed by their own products — is also untenable. The *mechanical, humoral* and *phagocytosis* theories, which teach that the bacteria are destroyed by the humors or cells of the body, are partly true, but do not convey the whole truth, which in fact may never be known. The most popular theories of the present time are chemical, and that known as Ehrlich's *side-chain theory* is uppermost in discussion. This theory is extremely elaborate, but its fundamental principle is that the blood-serum of man and other animals may be so modified, in whole or in part — experimentally played upon, as it were — that it can be made to overcome the effects of infections, of poisons, or of both. The development of the diphtheria antitoxin in the blood-serum of the horse, to counteract the effects of the toxin of the diphtheria bacillus in man, was the first important practical deduction of this great principle. It was the first illustration of the production of a successful passive immunity in human pathology. In the discovery of the diphtheria antitoxin it was hoped that all the infectious diseases were conquered, but this hope was premature, as it was learned that other diseases involved other factors of a more elusive character than the simple toxin. The destruction not only of the bacteria within the body, but the neutralization of the poison as well, was found necessary, and hence the terms bacteriolytic immunity and antitoxic immunity. Ehrlich's side-chain theory tries to explain antitoxic immunity in chemical terms. He assumes that the cell-body has a number of side-chains upon it — receptors, as they are termed. These are capable of combining with food-products for the metabolism of the cell. There are certain receptors that can combine with toxic products as well, with damage to the cell. Antitoxins, according to Ehrlich, consist of surplus receptors made by the cell and cast off in the blood-serum. These unite with the toxin in the serum, and thus save the receptors of the cell for their normal food-taking properties. Any surplus of receptors over and above those combined with the toxin molecules floating in the blood are available as free antitoxins in the treatment of toxin-caused disease.

The other phase of the subject of immunity is concerned with the ability of bodies themselves to destroy bacteria — bacteriolytic immunity. It is known that if the blood-serum of certain animals is injected into an animal of a different species, the red blood-cells of the injected animal are destroyed. This process has been termed hæmolysis, and is observed under other conditions, as in poisoning by drugs, such as acetanilide, sulphonal, etc. A similar action of blood-serum on certain bacteria can be brought about by artificial means, thus manufacturing a *bacteriolytic* serum for use in destroying given bacteria in the human body. The various terms that are used in elaborating this hypothesis may best be expressed in the form of a chart, since in medical literature so many synonyms have been in vogue. See table next page.

As Prudden writes, «there seems to be abundant ground for the belief that the protective agencies which are evoked in both natural and artificial immunization are simply those which the body makes use of in its normal metabolism, exaggerated and diverted to different ends, it is true, in the face of emergencies, but giving evidence of the birth of no new physiological capacities.» «The new methods of research and the far-reaching conceptions which they have stimulated and fostered seem likely to mark a new era in physiological chemistry, and to link more closely than any other extension of knowledge in our time some of the most subtle and urgent problems of medicine to the wider outlooks of general biology.» See PATHOLOGY.

TABLE SHOWING VARIOUS FORMS OF ADAPTATION PRODUCTS WITH THEIR RELATIONSHIPS AND SYNONYMS. (FROM PRUDDEN).

A	The body-cells in adaptation to alien substances of protoplasmic origin may elaborate	Antitoxins Antiferments Cytolysins (Cytotoxins) Agglutinins Precipitins	Hæmolysins Bacteriolysins Special Cytotoxins	Formed of two substances	COMPLEMENT Alexin Addiment Cytase AMBOCEPTOR Immune body Intermediary body *Substance Sensibilatrice* Copula Desmon
B	The " Antibodies "	Cytotoxins Agglutinins Precipitins	May lead to the formation of anti-antibodies.	Anticytotoxins Anti-agglutinins Antiprecipitins	Anti-complement Anti-amboceptor.

Consult Welch, 'Recent Studies on Immunity' (*Medical News,* 18 Oct. 1902); Prudden (*Medical Record,* 14 Feb, 1903); Ritchie (*Journal of Hygiene,* Vol. II, Nos. 2, 3, 4, 1902); and for general works, Flügge, 'Die Mikroorganismen'; Muir and Ritchie, 'Manual of Bacteriology' (1903); Kolle and Wassermann, 'Bacteriology' (1903); Zinsser, 'Immunity' (1917).

IMOLA, ē'mō-lä, **Innocenzo da,** Italian painter, who took the name of his native town Imola, where he was born about 1480 and died about 1550. At the time in which he flourished family names were not so much used as at present and it was quite a common occurrence to name a person familiarly and constantly from the place, district or country of his origin. So Innocenzo di Pietro Francucci was called and answered to the name Imola. He was one of the trade artists and decorators of his day and worked in the shops of several noted painters who contracted for large orders for decorative paintings for churches and occasionally for other purposes, including shipments of paintings to the Spanish colonies in America, more especially to Mexico. He seems to have learned from the various great painters with whom he came into contact, imitating one after another. Thus, at various stages in his life his work carries reminiscences of his different masters. In his later work his coloring is strongly in the style of Raphael. Imola's figures are graceful and his designs good and generally satisfying but they lack the originality and inspiration of the greater artists of his day. Among his paintings are the frescoes in the church of San Michele of the Wood, Bologna, which were for a long time painted over with water-colors. These fine paintings, which cover the walls and roof of the ancient choir of the edifice, represent the 'Burial of the Virgin'; the 'Assumption of the Virgin'; the 'Annunciation'; the 'Resurrection of Jesus'; 'San Michael overcoming the Devil,' and the 'Four Evangelists.' The 'Marriage of Saint Catherine,' the 'Virgin Surrounded by Saints,' and three Madonnas are all in the gallery of the Museum. The cathedral of Imola possesses a 'Virgin and Saint Paul'; 'Saint Peter'; 'Zachariah and Saint Isabel.' Other works are in Munich, Berlin, Petrograd and Rome.

IMOLA, Italy, city in the province of Bologna, on the Santerno, 20 miles southeast of Bologna. It contains an ancient cathedral, two other interesting churches, several fine palaces, a communal library, a citadel, prison, lunatic asylum and an agricultural school. Its industrial establishments include silk mills, soap and leather works, brickyards and gunpowder works. Wine and vegetables are important items of trade. Imola is the Roman Forum Cornelii, a station of the Via Æmilia. For centuries it was little heard of until the period of the ascendancy of the Lombards. In 1480 it came into the possession of the lords of Forli and in 1500 was added to the states of the Church. Pop. 86,000.

IMPACT, the action which results on the coming together of two bodies, one or both of them in motion. If an ivory ball fall on a marble table which has a thin coating of oil, after impact the ball is found to have on its surface a patch of oil, which shows by its size that the ball must have been compressed at the moment of impact. When two bodies come into collision they compress each other at the points that touch until they have each the same velocity; during this time of compression each body acts upon the other with exactly the same impulse, the momentum lost by the one being gained by the other; if now the bodies are perfectly inelastic no further mutual rebound will take place; if the bodies are elastic they will regain their old shape, and the mutual impulsive forces of restitution will cause separation. The impulsive forces of restitution are found to be less than those of compression; that is (see IMPULSE), the momentum lost or gained by either of the bodies during the second or restitution part of the impact is less than the momentum lost or gained in the first or compression part of the impact in a certain ratio which is called the elasticity of the bodies. In a perfectly elastic body this ratio would be equal to 1, in a perfectly inelastic body it is 0.

Thus, when one ivory ball comes into direct collision with another of equal size at rest, the first comes to rest and the second moves in the direction of motion of the first before impact, but with a slightly diminished velocity. When two equal ivory balls come together with equal and opposite velocities each returns on its old path with a velocity slightly lessened. When one perfectly inelastic body overtakes or meets another directly the common velocity after impact is equal to the sum or difference of momenta of the bodies before impact divided by the sum of the masses.

In a collision of two balls not perfectly elastic it may be shown that the total energy of motion (see ENERGY) of the two balls after collision is less than it was before, some of it having been converted into heat.

IMPALE, in heraldry, the arrangement of two coats of arms on one shield and side by side with a pale marking the division. See HERALDRY.

IMPANATION. See CONSUBSTANTIATION.

IMPEACHMENT. A trial, usually of a public officer, for a high crime or other offense. In England the House of Commons is the prosecutor and the issue is tried and determined before the House of Lords. Impeachment in England dates back to a very early day, and has continued, with some interruptions in the 15th, 16th and 17th centuries, to the present. It has now lost much of its former importance. The charges against the defendant are in the form of articles, and he may employ counsel to represent him and call witnesses in his defense. The vote of each peer on the question of the guilt of the defendant is taken separately, and if he is found guilty, the Commons may or may not move for judgment as they see fit, frequently refusing to do so, which amounts virtually to a pardon. Political offenders may be impeached when danger exists of their escaping punishment by the usual methods. Impeachment lies against persons of all ranks and for misdemeanors and crimes of all degrees. The practice of impeaching ministers has been rendered obsolete by the doctrine of ministerial responsibility to Parliament. Likewise the impeachment of judges is no longer necessary, the power of removal existing in the Crown.

In the United States by the constitutions of most of the States impeachment proceedings are instituted in the Senate, although in a few States the ordinary courts of law have jurisdiction of such proceedings. There is considerable conflict of judicial opinion on the question of impeachment, particularly on the offenses for which it lies, whether a State officer is subject to impeachment after he has ceased to hold office, etc. An offender who has been impeached may, in certain cases, later be tried and punished by the courts for the same offense. By constitutional provision in many jurisdictions none but State officers are subject to impeachment, and this necessarily excludes county and municipal officers. Among some of the offenses which by constitutional provisions are subject to impeachment are treason, bribery, misconduct and maladministration in office, habitual drunkenness, neglect of duty, common law and statutory crimes and corrupt practices and oppressive conduct by judges and others. The rules of evidence in impeachment proceedings are the same as those which prevail in criminal trials. To justify a conviction, therefore, the guilt of the accused must be established beyond a reasonable doubt. Under the constitutions of some of the States no person may be impeached by a concurrence of less than two-thirds of the senators elected.

There is a marked difference in some particulars in impeachment proceedings in the United States and England. For instance, in the United States the only penalty after impeachment is removal from office, while in England any legal penalty, even capital punishment, may be inflicted. In many of the States, by constitutional provision, cases of impeachment are excepted from the pardoning power, whereas in England, as stated above, the Commons have virtually the pardoning power in all cases. In England a commoner may be arrested when impeached or he may be compelled to give security for his appearance, and a peer may be arrested for a capital offense, while in the United States there is no power of arrest in any case.

IMPEDIMENTS TO MARRIAGE. See MARRIAGE.

IMPERIAL, Cal., city of Imperial County, on the Southern Pacific, 25 miles south of Old Beach. It contains a meat-packing plant, creamery, cement works, cotton compress, a soap works and a stock yard. The water supply system is owned by the municipality, which also maintains a public library and a high school. The city is situated in the famous Imperial Valley, where irrigation is extensively practised. Pop. 1,250.

IMPERIAL CITY, a designation of Rome, for ages the mistress of the world.

IMPERIAL FEDERATION, a term in English politics for the consolidation of the British Empire, so as to combine its resources for the maintenance and defense of common interests, while leaving intact the existing rights of colonial parliaments in local affairs. The idea was first advocated by Thomas Pownall, governor of Massachusetts in 1764. In the 19th century one of its most outstanding colonial advocates was Joseph Howe, the Canadian statesman. The foundation of the Imperial Federation League by W. E. Forster in 1884 may be said to have marked the beginning of organized movement in this direction. The celebration of the 60th year of Victoria's reign in 1897 was the occasion of a gathering in London of the prime ministers of all the self-governing colonies, who were entertained as the guests of the country. This was the third occasion of a meeting of representatives of the colonies, the first having met in London in 1887 and the second in Ottawa in 1894. After taking part in the queen's procession and the attendant festivities the premiers met the Secretary of State for the Colonies (Chamberlain) in conference. The subject of Imperial Federation was discussed at one of these meetings; and though more than one of the premiers directly advocated the representation of the colonies in a council sitting in London, the opinion of the greater number was expressed in the observation that the colonies were very well as they were at present. Further conferences were held in 1902, 1907 and 1911. The 1902 conference agreed to co-operate with the imperial authorities as regards defense; Australia and South Africa offered to contribute to the cost of the British navy; a resolution was passed declaring that free trade within the empire was not practicable; but favored inter-imperial preference. This conference was presided over by Chamberlain, the strongest advocate of reciprocal preferences. But in 1907, with a Liberal government in power pledged to the maintenance of free trade, the reaffirming of the resolution passed in 1902 on imperial preference was strongly dissented from by the representatives of the home government. The creation of an imperial general staff was approved, as was a British resolution in favor of fiscal freedom to each part of the empire. In 1911 imperial preference was not brought up, and a resolution in favor of giving the self-governing dominions liberty to withdraw from most-favored-nation treaties was passed, but owing to the strong opposition of foreign governments no steps have been taken in this regard. These conferences, it may be said, are held every four years, the Prime Minister of Great Britain, the Colonial Secretary, and the prime ministers of the self-governing dominions being designated as the ex-officio members. The delegates, however, have no power to bind their respective countries. Partly as a result of these conferences various modifications in the fiscal policies of the dominions and colonies have taken place. In 1897 Canada granted unconditional preference on British goods and this was subsequently increased. The West Indies, Ceylon, the Straits Settlements and New South Wales were accorded the preferential terms of the Canadian tariff in 1898. The South African Customs Union established a British preference in 1903, to which Canada was admitted a year later; and in the same year New Zealand granted a British preference on a limited list of imports. One of the most valuable results of the Imperial Federation movement and of the various imperial conferences has been in a co-ordinated scheme of defense for the whole empire and in the sharing of the burden. The outbreak of the Great European War saw a rallying of all the dominions to the help of the mother country, and that although they were free to assist or to refrain from lending assistance.

Consult Chamberlain, 'Imperial Union and Tariff Reform' (speeches); the proceedings of the several imperial conferences; Seeley, 'The Expansion of England'; Jebb, 'The British Question: A Survey of Alternatives'; Kirkpatrick, 'Imperial Defence and Trade'; Pollard, 'The British Empire'; Amery, 'Union and Strength'; Lucas, 'Greater Rome and Greater Britain.'

IMPERIAL GUARD, the name given to the consular guard when Napoleon I became emperor of France in 1804. At first it was about equal to a division. It fought with good effect at Austerlitz and Jena. Afterward it was greatly increased, being subdivided into «Old Guard,» «Middle Guard» and «Young Guard,» and in 1814 amounted to more than 100,000 men. It was disbanded in 1815, but revived by Napoleon III on 1 May 1854, and took part in the Crimean War in 1855. In 1870 it surrendered at Metz to the Germans and was soon after abolished. Consult Houssaye, H., and others, ed., 'La Vielle Garde Imperiale' (Tours n.d.).

IMPERIAL INSTITUTE. The Imperial Institute of the United Kingdom, the Colonies and India, designed to commemorate the jubilee of Queen Victoria (1887), aims at comprising complete collections of the products of the various parts of the British Empire, a commercial intelligence department for the promotion of trade and industry and a great school of modern Oriental languages (opened in 1890). In 1902 its management was transferred to the Board of Trade.

IMPERIAL SERVICE ORDER, The, an order instituted by Edward VII, in 1902, and designed to honor those who have served the Crown at home or abroad continuously for a term of years. The term is usually 25 years, but those who serve in torrid or unhealthful regions of the colonies may receive the order after 16 years of service. The order comprises a sovereign and 425 companions. Of the latter 250 must belong to the Home Service and the remainder to the Colonial Service.

IMPERIAL VALLEY, a large section of country in the middle of Imperial County, Cal. The county is 84 miles long from east to west and 54 miles from north to south and has an area of 4,536 square miles or about 2,600,000 acres. Its southern boundary is the international line between Mexico and the United States; its eastern line is the Colorado River; on the north is Riverside County, while on the west the San Jacinto or Coast Range of mountains separates it from San Diego County. The territory is below sea-level and some 300 feet below the level of the Colorado River to the east. In the northeastern part of the county is the Salton Sink or Sea, which has a water surface area of 247 square miles. The Imperial Valley section of this county is about 400,000 acres in extent, nearly one-sixth of the entire county area. It extends from the boundary line on the south 40 miles northward and has a width of about 30 miles. The climate of the section is one of great heat and dryness. Summer temperature is sometimes as high as 112° or 116°, but there is a very low humidity. The winter is mild, the temperature rarely falling below the freezing point. Precipitation is small and variable. The average annual rainfall at Imperial City for a period of five years was 4.45 inches.

The territory was part of what for generations had been known as the great Colorado Desert, an arid land with temperature rising as high as 125° to 140°, a barren waste where neither man nor beast could live. The silt which had been deposited by the river had made a good soil, although scientists were slow to recognize this. But when the subject of the irrigation of Western lands in the United States assumed prominence after about 1890, it was realized that this desert valley was a rich field for reclamation. Plans for irrigation were considered before 1900 and were tentatively entered upon at once. Within six years from the beginning of irrigation there were 125,000 acres of productive farm land in the valley, 40,000 acres of alfalfa and 85,000 acres of grain and other crops, 20,000 head of beef cattle, 4,000 milch cows and much other stock. The annual production of commodities for shipment reached the value of $2,000,000. The range of products is wide. The land is too valuable for grazing or grain crops but an extensive system of farming fruits and vegetables is the best paying. Cantaloupes, asparagus, alfalfa, grapes, oranges, onions, honey, hogs, poultry and dairy products are the main dependence of the farmers. Dates are also being cultivated. Cotton culture has been introduced and a great success has been attained in the growth of the valuable long staple cotton.

Imperial was the first town established, located near the centre of the valley. The county-seat is El Centro. Brawley, termed the «Garden City,» is the distributing and shipping point for 80,000 acres of rich farming country. Holtville on the banks of the Alamo River, Calexico, on the southern border of the county, and Heber, situated half way between Calexico and El Centro: these three complete the sextette of the valley towns, all which, except Heber, were incorporated towns of the sixth class in 1909.

The water that irrigates Imperial Valley is taken from the Colorado River at a point four miles north of the international boundary line near Yuma, Ariz. The headings there provide for the admission of water sufficient for more than two and a quarter million acres of land. The canal carries the water to the former channel of the Alamo River leading northward toward the Salton Sea and the first 60 miles, over a semi-circular course, are in Mexico. Just before leaving Mexican territory and entering Imperial Valley the canal divides into four main branches and these main canals are in turn divided and subdivided again and again until the net work of waterways covers the entire valley, there being in all over 1,000 canal miles.

In 1905 the floods of the Colorado River breaking through a canal cut which had been made on Mexican soil, just south of the boundary line, widened and deepened until the entire flow of the river was turned west down the steep slope of the hills into the valley and the Salton Sink, threatening the destruction of farms and other property.

The situation was serious and President Roosevelt took cognizance of it by action and by a subsequent message to Congress that raised what up to that time had been a matter of merely local interest and importance into a question of national concern. To aid in the efforts to close the break, the Southern Pacific Railroad, whose tracks were imperiled and whose traffic was seriously impeded, took charge of the situation. The break was closed in November 1906. A month later there was another runaway of the river and the water broke through the newly constructed levees, again forcing itself into the basin of the Salton Sink.

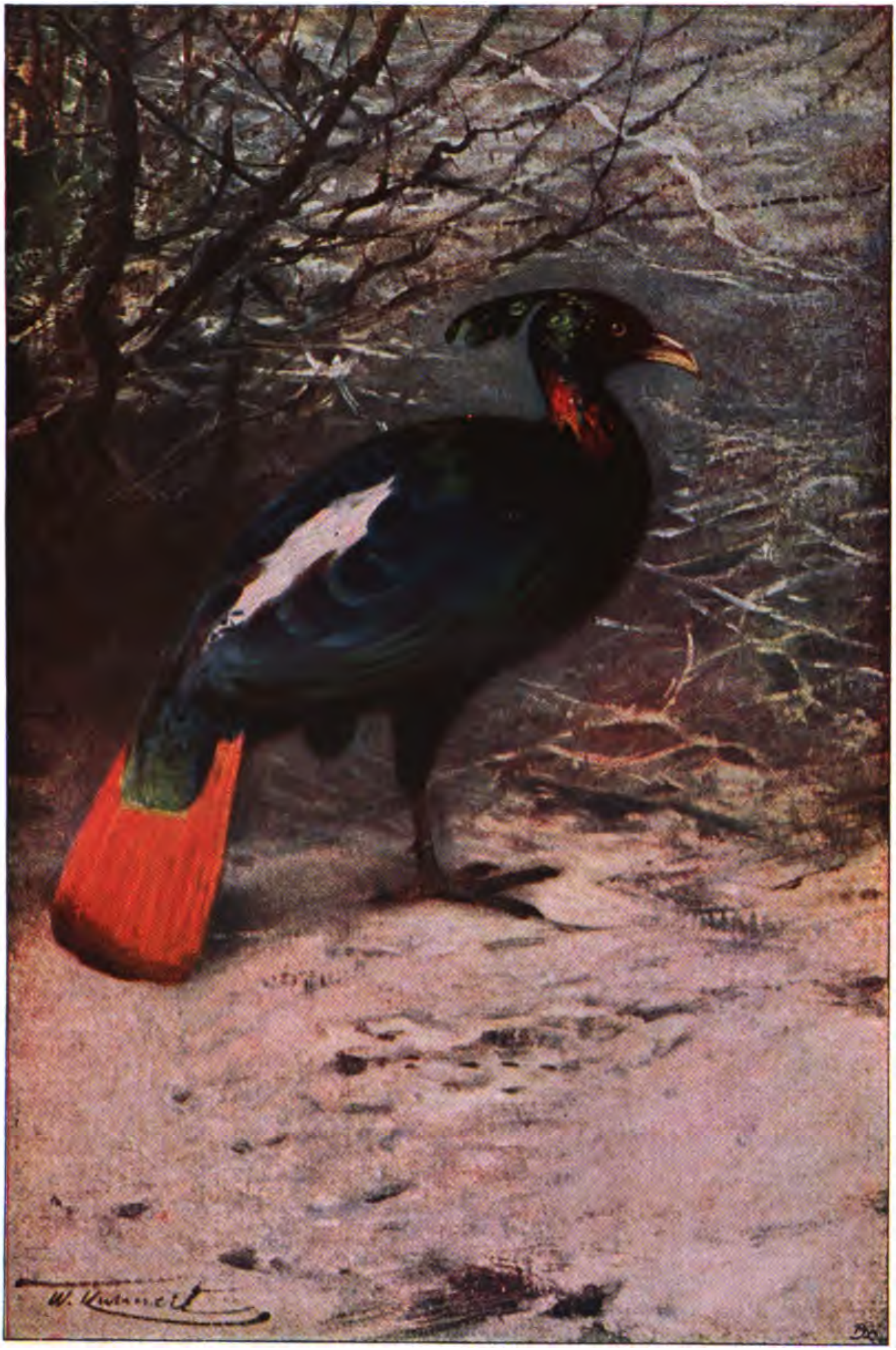
In this emergency President Roosevelt without waiting for congressional action arranged with the Southern Pacific Railroad to go on with the work of repairing the break and restoring the river to its proper channel in order to save the valley and the Laguna Dam which was then in process of construction by the government. This work was successfully done and in 1911 Congress reimbursed the railroad company for the expenses which it had incurred. This relief accomplished, measures were at once instituted for the permanent protection of the valley from the annual floods of the Colorado River and for the meeting of its irrigation needs.

IMPERIALISM, the national policy which tends toward the expansion of national domination and national ideas over a geographical area wider than that of national boundaries. As a policy, it is as old as civilization itself; an empire was established by the Hyskos which extended from Euphrates to the Nile, and a great Egyptian empire was established by Thothmes III. Thus ancient Rome extended her dominion and system of government, her laws and language first over the whole of Italy, then over Sicily, northern Africa, Spain, Gaul, Britain, Greece and parts of Asia. Charlemagne's idea was to hold France, Germany and Spain under one imperial head. Napoleon wished his empire to comprise all Europe. English nationalism has been partly a wide scheme of colonization, and partly, as in India, a plan for bringing under British rule, a cluster of Oriental races, while leaving them free in regard to local laws, customs and beliefs. Nothing has been more remarkable within the last 40 years than the overseas expansions of territory on the part of the greater powers. Great Britain, France, Germany, Russia, Italy, Belgium, Japan and the United States have all engaged in the quest for territory. Germany's rise as a colonial power dates from 1880, with the founding of the German Commercial and Plantation Association of the South Seas and the first territorial acquisition in Samoa. The impulse to expansion was given by the great wave of protection that followed after the Franco-Prussian War, and by the desire to arrest the tide of German immigration to the United States by affording room for adventurous youth under its own flag. Land hunger, the control of markets for raw material and the exploitation of native races, the seeking of outlets for surplus population, and the necessity for defensible and scientific frontiers, are among the motives which impel the powers to seek expansion. In the case of the United States, the succession to the colonial estate from which Spain was dispossessed as a result of the Spanish-American War, the shrinkage in the size of the world from what it was in the days of the Founders of the Republic, and the legitimate fear that the island outposts of the Americas, or even part of the South American continent, might be seized on by such an aggressive and overmastering power as the German Empire, has caused the departure from its former position of splendid isolation to be acquiesced in by the people of the United States. «Bearing the white man's burden,» to quote Kipling; «pegging out claims for posterity,» in the words of Lord Rosebery; and the arrogant image of the Emperor Wilhelm II, «seeking a place in the sun,» are some of the phrases employed descriptive of modern Imperialism. But, in the opinion of its adversaries, it is held to evoke a spirit of aggressive and exclusive nationalism, protectionist in its trade policy,— and that too, while it is admitted that the policy of the British Empire, the largest holder of overseas estate has up to the present time been to grant to foreign nations in the colonies and dependencies equal trading privileges with its own subjects. But the Imperialism Movement with which the name of Chamberlain is associated was frankly exclusive and protectionist, and the majority of the more enthusiastic British Imperialists are ardent protectionists. And there is no doubt that the national

IMPEYAN

[illegible] to save one [illegible] which was [illegible] Congress [illegible] the railroad company for the expenses which [illegible] incurred. [illegible] were at once [illegible] protection of the [illegible] of the Colorado River and [illegible] interests of its irrigation needs.

[illegible]



IMPEYAN PHEASANT (*Lophophorus impeyanus*).

jealousies excited by the scramble for markets and the passion to acquire colonial possessions have been a fruitful source of international suspicions and perturbations, and contributed not a little to the jealous and acquisitive temper that found its culmination in the disastrous struggle that broke on the world in August 1914. In the United States the term imperialism has been used in a more or less factitious sense. The avowed object of the government at Washington in the Spanish War was the liberation of Cuba from the Spanish yoke. The term «imperialism» was employed as a political catch-word in the Presidential campaign of 1900, especially with regard to the purchase of the Philippines. The other extra-territorial possessions of the United States are Alaska, Porto Rico, Hawaii, Guam, Samoan Islands and Virgin Islands of the United States (formerly Danish West Indies). The Supreme Court on 2 Dec. 1901 decided on the constitutionality of expansion. The principles settled by the decision are thus to be stated: (1) The Constitution does not follow the flag till it is planted on new territory by special act of Congress. (2) The extension of the sovereignty of the United States to new territory guarantees the enjoyment of liberty, the right to property and the protection of the United States to the people thus affected in securing justice and public order and promoting peaceful progress. (3) The islands acquired from Spain by the Treaty of Paris are «property of the United States,» and Congress can dispose of these islands in any way conducive to the interests of the people of the United States and of these islands.

A corollary of these propositions finds expression in the statement that the territory of the United States may be described under three heads: (1) The States. (2) Incorporated Territories. (3) Unincorporated territory, belonging to the United States.

This gives to the nation three different classes of people dependent upon it: (1) Citizens vested with full political power, or the residents of the States. (2) Citizens of the incorporated Territories, who are not vested with full political power as long as they are residents of the incorporated Territories. (3) The people of the «territory belonging to the United States,» as such, who cannot become citizens of the United States till Congress extends to such territory they occupy the privileges of the Constitution.

IMPETIGO, ĭm-pĕ-tī'gō, popularly known as Pustular Tetter, Honey Scab and Honey Sickness, a skin disease found mostly in children, consisting in an eruption of itching pustules, appearing in clusters, and terminating in a yellow, thin, scaly crust. They appear chiefly on the head and face, and sometimes on the hand. Feverishness and sensations of chilliness accompany the disease. The treatment is both external and internal, the former consisting in the application of ointments, as graphite. An incomplete diet is believed to be a prominent cause.

IMPEYAN (ĭm'pĭ-an) **PHEASANT,** a pheasant of the genus *Lophophorus* generally; specifically, the species (*L. impeycinus*) of southern Kashmir, first brought to notice by Lord and Lady Impey. These are among the most splendidly clothed of birds, rivaling the humming birds in the brilliance of their metallic hues. There are four or five species, each restricted to a particular region in southeastern Asia. The Himalayan species or Monal (*L. refulgens*) is the best known and is often exhibited in zoological gardens. The male is perhaps the most gorgeous of the *Phasianidæ*, presenting a wonderful combination of sparkling metallic purples, blues, browns and greens, with golden and coppery reflections and contrasting patches of snowy white and deep black; on the head is a crest composed of long racquet-shaped feathers. The female is plainly colored. High up in the mountains near the snow line the monal lives during the summer, breeding up to an elevation of 12,000 feet, but in the autumn, as the weather becomes cold, it gathers into flocks and descends to the deep woods or, in very severe weather, even to the cultivated lowlands. It both runs and flies swiftly, but is chiefly terrestrial, and feeds largely on roots and grubs dug from the ground. The impeyan pheasant has the black and white areas replaced by golden green.

IMPLEMENTS, Agricultural. See Farm Machinery.

IMPORTANCE OF BEING EARNEST, The. If one were to select a single one of Oscar Wilde's plays which should best exemplify his contribution to English drama, one might well choose 'The Importance of Being Earnest,' although it is neither the most important nor the best known of them. This apparent contradiction is explained by the fact that, being a farce (his only one), the artificial conventionality of plot and the unreality of the characters which so obviously mar his comedies, are not conspicuous faults in this gay trifle. Consequently one can give oneself up unreservedly to the enjoyment of the play of brilliant wit and delicate satire of which Wilde was a master. Here is «literary farce,» *par excellence*. The dialogue is a continuous succession of sparkling epigrams, witty paradoxes, quick repartee and delightful, unexpected turns of phrase. Even the title is a clever pun.

In plot and technical structure also, Wilde shows himself less conventional and more ingenious in this play, slight as it is, than in most of his others. In a very amusing scene between two young gentlemen in the first act it transpires that Jack, who lives in the country and is constrained to lead a very decorous life there on account of a young ward who lives in his household, has invented a scapegrace brother, named Ernest, whose supposed escapades furnish the excuse for Jack's frequent visits to town. Algernon, on the other hand, has invented an elderly invalid friend in the country to whom he is touchingly devoted whenever he wishes to escape a tiresome engagement in town. These imaginary characters are utilized to build up a series of delightfully absurd situations in the second act for which the audience has been skilfully prepared but which are nevertheless unexpected.

'The Importance of Being Earnest' was written in 1895, shortly before its author's sensational trial and imprisonment, and was the last play that he wrote. It was first produced at the Saint James Theatre in London in February 1895, and later in the same year at the Empire Theatre in New York.

Grace R. Robinson.

IMPORTS AND EXPORTS, taken together, represent the foreign trade of a country; and, as such, they are indicative of its commercial status among nations. Imports are classified as those for consumption by the population, and those for re-export. In the classification of exports, therefore, the re-exports appear again, along with the domestic production of the country. Generally speaking, a large volume and variety of imports for consumption are the mark of a prosperous people of many wants, and of means to buy to their satisfaction; and large imports usually are accompanied by large exports, the latter going to pay for the former, as near as may be, the balance of the account being settled in gold.

The relative activities of populations may therefore be gauged in large measure by their imports and exports. Thus, in Table A, the best showing is made by New Zealand's people, with a per capita export of $141, and a per capita import of $110. They not only paid with their exports for what they imported, but the balance of trade was in their favor by $31 per capita. Next in rank comes Switzerland, with a per capita of $122 export, and $118 import. Belgium and the Netherlands each show a total foreign trade of $221 per capita, although the balance of trade is against them. At the other end of the scales are Liberia, with a total foreign trade of less than $1; China, with less than $3; and British India, with but little over $3.

The dates given in the table are the latest complete figures issued authoritatively by the individual countries named.

TABLE A

COUNTRY	Population	Imports	Exports
Argentina 1916	8,066,000	$209,800,000	$524,329,000
Australia, 1916	4,875,000	373,400,000	299,999,000
Austria-Hungary, 1913	52,368,000	691,538,000	562,247,000
Belgium, 1913	7,658,000	974,623,000	717,152,000
Belgian Kongo, 1912	15,000,000	10,467,000	11,566,000
Bolivia, 1915	2,890,000	8,789,000	37,067,000
Brazil, 1916	26,542,000	195,998,000	267,081,000
Bulgaria, 1911	4,753,000	38,474,000	34,634,000
Canada, 1917	8,075,000	845,331,000	1,151,375,000
Central American States:			
Costa Rica, 1915	431,000	4,479,000	9,972,000
Guatemala, 1915	2,119,000	5,072,000	11,567,000
Honduras, 1915	562,000	5,874,000	3,142,000
Nicaragua, 1916	704,000	4,778,000	5,285,000
Panama, 1916	400,000	9,197,000	5,707,000
Salvador, 1916	1,268,000	5,668,000	9,970,000
Chile, 1915	3,641,000	55,992,000	119,530,000
China, 1916	336,042,000	427,755,000	399,087,000
Columbia, 1915	5,071,000	17,364,000	27,879,000
Cuba, 1916	2,628,000	215,962,000	320,719,000
Denmark, 1914	2,921,000	213,137,000	209,101,000
Dominican Republic, 1916	725,000	11,664,000	21,528,000
Ecuador, 1915	2,000,000	7,008,000	12,922,000
Egypt, 1916	12,566,000	149,892,000	185,177,000
The Sudan, 1916	3,381,000	13,156,000	11,312,000
France, 1916	39,700,000	2,925,767,000	987,328,000
Algeria, 1915	5,564,000	72,011,000	91,235,000
Tunis, 1916	1,939,000	25,911,000	22,927,000
French Indo-China, 1913	16,990,000	45,318,000	55,094,000
Other colonies, 1913	25,242,000	72,395,000	63,810,000
Germany, 1913	68,059,000	2,563,354,000	2,403,311,000
German colonies, 1912	13,068,000	33,958,000	28,769,000
Greece, 1914	4,950,000	34,475,000	23,547,000
Haiti, 1913	2,500,000	10,935,000	17,273,000
India, British, 1916	315,156,000	426,112,000	624,645,000
Italy, 1916	36,546,000	1,053,448,000	442,489,000
Eritrea, 1915	450,000	4,559,000	2,703,000
Libia, 1913	1,000,000	5,107,000	4,686,000
Japan, 1916	55,965,000	377,079,000	556,697,000
Formosa, 1916	3,711,000	53,698,000	31,649,000
Chosen, 1915	16,913,000	29,481,000	24,647,000
Liberia, 1913	1,500,000	1,411,000	1,112,000
Mexico, 1913	15,502,000	93,020,000	129,971,000
Montenegro, 1911	516,000	1,658,000	486,000
Morocco, 1914	5,000,000	44,668,000	7,311,000
Netherlands, 1915	6,583,000	848,552,000	703,193,000
Dutch East Indies, 1915	47,956,000	232,615,000	304,798,000
New Zealand, 1916	1,101,000	121,883,000	155,908,000
Norway, 1915	2,509,000	232,615,000	177,147,000
Paraguay, 1915	1,000,000	4,489,000	4,692,000
Persia, 1915	9,500,000	41,268,000	33,469,000
Peru, 1916	5,800,000	42,257,000	80,497,000
Portugal, 1914	5,958,000	74,877,000	29,318,000
Rumania, 1913	7,508,000	113,872,000	129,446,000
Russia, 1915	178,905,000	586,360,000	206,945,000
Finland, 1914	3,269,000	73,372,000	54,464,000
Serbia, 1912	4,622,000	20,476,000	16,255,000
Siam, 1916	8,266,000	32,582,000	45,058,000
Spain, 1915	20,500,000	241,418,000	251,656,000
Sweden, 1914	5,713,000	194,811,000	206,991,000
Switzerland, 1916	3,880,000	459,051,000	472,409,000
Turkey, 1912	21,274,000	193,024,000	105,009,000
Union of South Africa, 1916	6,465,000	188,622,000	104,237,000
United Kingdom, 1917	46,089,000	4,141,101,000	2,463,810,000
British Colonies, 1914	46,521,000	51,983,000	71,715,000
United States, 1917	105,015,000	2,659,355,000	6,227,164,000
Philippine Islands, 1917	8,918,000	51,983,000	71,715,000
Porto Rico, 1917	1,231,000	53,545,000	80,971,000
Uruguay, 1915	1,346,000	36,276,000	75,797,000
Venezuela, 1916	2,816,000	20,634,000	22,707,000

Table B gives the imports and exports of the United States for the fiscal years ending on 30 June of the several years quoted. With the values of imports are included the value of goods intended for re-export, which appear in another column. The last column shows the balance of trade from year to year, in all cases in favor of this country. The effect of the war upon the foreign trade of this country is plainly exhibited.

TABLE B

YEAR	Imports	Re-exports	Domestic exports	Balance of trade
1880	$667,954,746	$11,092,305	$823,946,253	$167,683,912
1890	789,310,409	12,534,856	845,293,828	68,518,275
1900	849,941,184	23,719,511	1,370,763,571	544,541,898
1905	1,117,513,071	26,817,025	1,491,744,641	401,048,575
1906	1,226,562,446	25,911,118	1,717,953,382	517,302,084
1907	1,434,421,425	27,133,044	1,853,718,034	446,429,653
1908	1,194,341,792	25,986,989	1,834,786,357	666,431,554
1909	1,311,920,224	24,655,511	1,638,355,593	351,090,880
1910	1,556,947,430	34,900,722	1,710,083,998	188,037,290
1911	1,527,226,105	35,771,174	2,013,549,025	522,094,094
1912	1,653,264,934	34,002,581	2,170,319,828	551,057,475
1913	1,813,008,234	37,377,791	2,428,506,358	652,875,915
1914	1,893,925,657	34,895,123	2,329,684,025	470,653,491
1915	1,674,169,740	52,410,875	2,716,178,465	1,094,419,600
1916	2,197,883,510	61,305,306	4,272,177,579	2,135,599,375
1917	2,659,355,185	62,884,344	6,227,164,050	3,630,693,209
1918	2,946,059,403	81,125,963	5,847,159,678	2,982,226,238

IMPOST, in architecture, the plane or place at which a horizontal stone, beam, arch, etc., rests on the column, pier or wall. It is often marked by horizontal moldings. Imposts have received various names, according to their character. Thus, a continuous impost is one in which the moldings are carried perpendicularly down the pier, as in the later decorated Gothic; a discontinuous impost, one where the moldings abut and are stopped on the pier; shafted imposts are those in which the arch moldings spring from a capital and differ from those of the pier.

IMPOSTS. The word may properly be used to designate any tax or levy, but specifically it signifies the duties levied on the foreign trade of a country, both imports and exports. The United States Constitution forbids the several States to lay imposts except such as may be necessary to secure adequate execution of inspection laws; and all moneys thus collected shall be turned over to the United States Treasury.

IMPOTENCY, a diseased condition of the male in which he is incapable of generation; any incapacity to perform the generative function, successfully. As such condition defeats the presumed object of marriage it is regarded as a bar, and cause for annulment, sometimes divorce, except when the natural result of old age. In the old common law failure to consummate the marriage relation within three years is presumptive evidence, and constitutes a sufficient ground for divorce, or annulment of marriage. As a cause for annulment or divorce it is in the United States a matter of State legislation.

IMPRESSIONISM is the name given to a school of painting that began to manifest itself in Paris in 1863, when the works of Edouard Manet (1832–83) and his friends were rejected by the Salon jury of that year. The emperor, Napoleon III, liberally minded, demanded that these innovators should at least have the right to exhibit together and a special room was given to them which was called the Salon des Refusés (Salon of Rejected Works). One of the most striking pictures there was a landscape at sunset by Claude Monet (1840) entitled an 'Impression.' The name was adopted for the new style; and painters who worked more or less in the same manner were called Impressionists. This group of men led by Manet, Monet, Edgar Dégas (1834–1918), Paul Cézanne (1839–1906), Camille Pissaro (1831–1903), Alfred Sisley (1840–99), and Auguste Renoir (1841), received nothing but abuse and ridicule for 30 years. Their pictures, which now command enormous prices, were condemned for years by the Parisian critics and painters who led the taste of the period. A few far-sighted patrons, however, encouraged these great artists who worked industriously and patiently, producing an enormous number of works and obeying the creative instinct without any other dogma than the passionate observation of nature. The Caillebotte collection, bequeathed by Gustave Caillebotte to the Luxembourg Gallery in Paris, and a special exhibition of their works at the Paris Exposition of 1900 compelled recognition. The public — in fact, the whole world — awoke (as it did to the sculpture of Rodin) to the truth and beauty of the Impressionist masters. To-day their place in art is unquestioned and secure.

Impressionist ideas may be summed up as follows: In nature no color exists by itself. The coloring of objects is a pure illusion. The only creative source of color is the sunlight which envelops all things. Our vision has formed the habit of discerning in the universe two things: form and color. Only artificially are outline and color distinguished one from the other. Light reveals the forms; and, playing upon different states of matter, i.e., the substance of leaves, the grain of stones, etc., the fluidity of the air, gives them dissimilar coloring. When the light disappears, forms and colors vanish. Everything has a color; and it is by the perception of the different color surfaces striking the eye, that forms, i.e., the outline of these colors, are perceived. The idea of distance, the idea of perspective and the idea of volume are given by darker, or lighter, colors. This is called in painting the sense of values; and values are the only means by which depth on a flat surface can be expressed. Color, being the irradiation of light, it follows that all color is composed of the same elements as sunlight, namely, the seven tones of the spectrum. These seven tones appear different, owing to the unequal speed of the waves of light. The colors vary with the intensity of light. There is no color peculiar to any object, but only more or less rapid variation of light. The speed depends, as is demonstrated by optics, on the degree of the inclination of the rays, which, according to their vertical or oblique direction, give different light and color. The colors of the spectrum are thus recomposed on every object. According to the time of day, i.e., according to the greater or smaller inclination of the rays (scientifically called the angle of incidence), the green of a leaf and the brown of a tree-trunk are modified. If a painter wishes to recall color to the beholder of a picture, the composition of the atmosphere which separates objects from the eye must be studied. Therefore, the atmosphere is the real subject of the picture, and whatever is represented only exists through its medium. Another principle is that shadow is not absence of light to be represented with ready-made tones of bitumen and black, but is light of a different quality and value. In a shadow the rays of the spectrum vibrate with different speed. The third conclusion resulting from this is that colors in the shadows are modified by refraction. For instance in a picture representing an interior the source of light (a window) may not be indicated. The light in the picture will be composed of the reflection of rays whose source is invisible and all the objects in the room catching reflections will consequently influence each other. Their colors will affect each other even if the surfaces be dull. A red vase placed on a blue carpet will lead to a very subtle but mathematically exact interchange between this blue and this red; and this exchange of luminous waves will create between the two colors a tone of reflections composed of both. These composite reflections will form a scale of tones complementary of the two principal colors. The science of optics can work out these complementary colors with mathematical exactness. If for example, a head receives the orange rays of daylight from one side and the bluish light of an interior from the other green reflections will necessarily appear on the nose and in the middle of the face. Here we touch upon the very foundations of Impressionism. The painter must paint with only the seven colors of the spectrum and discard all the others: that is what Claude Monet has done boldly, adding to them only white and black. Instead of composing mixtures on his palette the painter places on his canvas nothing but the seven colors juxtaposed, leaving the individual rays of each of these colors to blend at a certain distance, so as to act like sunlight itself upon the eye of the beholder. Such, then, is the dissociation of tones, which is the main point of Impressionist technique. It has the immense advantage of suppressing all mixtures, of leaving to each color its proper strength and consequently its freshness and brilliancy. The difficulties are extreme. The painter's eye must be subtle. Light becomes the sole subject of the picture: the interest of the object on which it plays is secondary. Painting becomes a purely optic art, a search for harmonies, a sort of natural poem, quite distinct from expression, style and design, which were the principal aims of former painting. It is only natural that it is principally in landscape painting that the Impressionists have achieved the greatness that is theirs.

Impressionism is more than a school: It is a *movement,* a reactionary movement, against classic and romantic subject. It is anti-intellectual, protesting against every literary, psychological, or symbolical subject, and warring against historical painting, mythological painting and false idealism, substituting for such subjects what might be summed up in the word *character.* To search for and to express the true character of a site, a human being, or an object, seems to the Impressionists more significant than to search for exclusive beauty. Before the days of Manet a distinction was made between *noble* subjects and *genre* (scenes of familiar life) subjects: the Impressionists consider all subjects worthy of the painter's brush, if nobly treated.

The Impressionists, coming immediately after the Barbizon School (Millet, Corot, Rousseau, Diaz, etc.), have had as much, if not more, influence than those painters who worked in the Forest of Fontainebleau. Among the principal exponents of Impressionism in other countries are the Americans, Childe Hassam, John S. Sargent, Henry Golden Dearth, J. W. Alexander and Mary Cassatt; the Spaniards, Sorollo y Bastida, Zuloaga, Dario de Regoyos and Rusiñol; the Italians, Boldini, Segantini and Michetti; the Danish, Kroyer; the Belgians, Théo van Rysselberghe, Claus, Verheyden, Heymans, Verstraete and Baertson; the Norwegian, Thaulow; the Dutch, Jongkind; and in England the «Glasgow School,» Lavery, Guthrie and John Lewis Brown. Consult Duret, ‘Les Impressionistes’ (Paris 1906); Mauclair, ‘The French Impressionists’ (London, n. d.); Muther, ‘History of Modern Painting’ (London 1896).

Esther Singleton.

IMPRESSMENT, the act of seizing (goods, etc.) for the public service, or of forcibly conscripting individuals for work in connection with war. When men are taken for the army or navy this is usually termed conscription in the draft (q.v.). As an act of military necessity many persons are more or less forced into activities in a war in which they are not directly engaged, and their conveyance, vessels, etc., may be commandeered in a very high-handed manner. Impressment was especially common in the English navy in the 16th and 17th centuries and well into the 18th. The merchant marine imitated the method in picking up sailors in ports. The right of changing one's natural allegiance (see Citizen; Embargo) was not acknowledged as a legal right in the 18th and early 19th century by any nation but the United States, which lacked power to enforce it against the world. Great Britain denied it, and Chancellor Kent early in the 19th century admitted that the denial was common law. During the Napoleonic wars, that country in its struggle for life, especially on the seas, demanded the help of all its citizens; and not only refused to recognize any ceremonies of naturalization, but seized its alleged subjects wherever it found them, searching neutral vessels on the high seas and impressing into its service whoever were claimed as such. The naval officers were the reverse of particular whether they made mistakes and kidnapped born Americans, and many hundreds of the latter were impressed in this way. Not only this, but the right of search in itself, were rasping grievances which worked up the national temper to the pitch of explosion, resulting in the War of 1812; the right of search resulted in the bloody outrage of the *Leopard* on the *Chespeake* (q.v.), which was one of the chief agencies in bringing about the Embargo.

IMPRISONMENT is one of the three classes of punishment for crime, death and penal servitude being the other two. It has always been a power inherent in courts of justice to imprison for contempt of their authority, and under certain conditions for nonpayment of debt. In criminal proceedings a person may, by a warrant of a justice of peace or magistrate, be imprisoned before trial, provided the justice considers it is not a proper case for allowing bail; and though in minor offenses an accused person may insist on being discharged on tendering sufficient bail, yet in more serious crimes it is in the discretion of the justice to accept or refuse the bail tendered, and on his refusal application may be made to judges of the common-law courts to accept bail. Imprisonment may be with or without hard labor, or it may be solitary. Penal servitude may be inflicted for life, or any shorter term, but in the case both of imprisonment and penal servitude the convict can at any time apply for commutation or remission. In the case of misdemeanors and other petty offenses tried summarily at common law and under a variety of statutes, imprisonment is usually awarded with the option of a fine. In the case of juveniles they are often said to be «detained» in a reformatory. Serious crimes as burglary, murderous assault, rape, counterfeiting, etc., receive long terms of imprisonment varying according to the laws of the States. The duration of term of imprisonment is usually partially in the discretion of the judge who sentences, and various laws specifying «imprisonment for not less than (so many) years and not more than (so many).» Provision is made for reduction of term in prison by reason of good behavior, and prison terms may be reduced by commutation of sentences or by subsequent pardon. In New York State one-year term means but 8 months and 20 days, if behavior is uniformly good, while a 10-year term can thus be reduced to 6 years, 1 month and 20 days and a 60-year term to 22 years, 8 months and 10 days. The unlawful detention of the person by any one, or «false imprisonment,» constitutes a personal injury, and may be treated as a criminal or as a civil offense. See DEBT; PENOLOGY.

IMPRISONMENT FOR DEBT is the restraint of the liberty of a debtor in a civil action. An arrest for debt is usually made by some mandate of a court having jurisdiction, after the nature and amount of the debt has been established by due process of law. But sometimes a debtor is restrained of his liberty on a preliminary proceeding, by order of a court, for the purpose of holding him to bail. In the United States, imprisonment for debt is made only by virtue of statutory regulations, several States having constitutional provisions prohibiting it under certain circumstances, and seven of them having absolutely prohibited restraint in any form of personal liberty on account of debt, by such provisions; namely, Alabama, Georgia, Maryland, Mississippi, Missouri, Tennessee and Texas. Several of the States provide in their constitutions that there shall be no imprisonment for debt except in cases of fraud on the part of the debtor. In some of the States acts have been passed providing for imprisonment founded on contracts deliberately entered into, while others have provided that only absconding debtors shall be subject to imprisonment. The tendency of modern legislation is adverse to imprisonment for debt. Many of the States have provided in case of imprisonment that the restraint shall be made as free from indignity as is consistent with the safe-keeping of the debtor, and that his restraint shall be considered more in the nature of misfortune than as punishment for an offense.

IMPROVED ORDER OF RED MEN, an American civic society, with benevolent and social characteristics, organized 14 Oct. 1833. Founded upon the manners, traditions and customs of the aborigines of the Western World, the Order adopted their unique figures of speech, which it transmits with historical accuracy. Knowing that some time the Indian race will become extinct it intends to occupy an original place in public interest as the repository of Indian customs, Indian traditions and Indian nomenclature. The Order's motto is «Freedom, Friendship and Charity.» Its interpretation, as promulgated by official authority, may be concisely stated in these words: Freedom, in honor of that race to whom the forests, the plains, the hills and the valleys of this land were as free as the air to the eagle, and in memory of the early struggles to wrest these United States from dependency to foreign rule. Friendship, to commemorate the unswerving loyalty with which an Indian maintained a noble and unselfish affection for him to whom it was plighted, and which makes sweet and lasting the relations that one member bears to another. Charity, the love expressed to a brother by those who meet around the brightly burning council fire; the sympathy which is pleased at his success, and the fraternal affection that grieves over his sorrows and disappointment.

Government.— The Order is organized along the familiar lines of civic societies. Its supreme power is the Great Council of the United States, and from this body emanates all authority for the establishment of local branches in towns and cities; also Great Councils in States and Territories and in the Dominion of Canada. State and Provincial Great Councils, under restricted delegated authority, exercise governmental oversight,— within their respective jurisdiction,— similar to that of the Great Council of the United States. Local branches of the Order are Tribes, Degree Councils and Councils of the Degree of Pocahontas. The Great Council of the United States has for its chiefs, or officers, the presiding and executive official, who is called the Great Incohonee; the Great Senior Sagamore, second in authority; Great Junior Sagamore, third officer; Great Prophet, who is often a Past Great Incohonee; the Great Chief of Records, or Grand Secretary; the Great Keeper of Wampum, or Grand Treasurer; Great Tocakon, the messenger of the presiding officer, or Grand Marshal; the Great Minewa, an officer in charge of the inner wicket; and the Great Guard of the Forest, guardian of the outer door. State Great Councils have chiefs whose duties correspond to the officers of the supreme body, as follows: Great Sachem, presiding chief; Great Senior Sagamore, Great Junior Sagamore, Great Prophet, Great Chief of Records, Great Keeper of Wampum, Great Sannap, Great Mishinewa, Great Guard of Wigwam, Great Guard of Forest. The chiefs of a tribe are: The Sachem, who presides; Senior Sagamore, Junior Sagamore, Prophet, Chief of Records, Keeper of Wampum, Collector of Wampum, First and Second Sannap, four Warriors, four Braves, the Guard of the Wigwam and Guard of the Forest. In Degree Councils the chiefs governing them are similar to those of a tribe. The Councils of Pocahontas admit white women to membership, and those of the order who have attained to the Chief's Degree. The chiefs of the council,— whose duties are defined in an ornate ritual,— are: Pocahontas, presiding officer; Wenonah, Powhatan, Keeper of Records, Collector of Wampum, Keeper of Wampum, First and Second Scout, First and Second Runner, two Counsellors, four Warriors, Guard of Wigwam, and Guard of the Forest. Provision has also been made for the establishment of State Great Councils of the Degree of Pocahontas, similar in authority to those of the Tribal Branch, the officers of which run parallel with local councils. The names of the chiefs have the prefix of «great,» and these Great Councils are given jurisdiction over this degree, all under the sovereignty of the Great Council of the United States. After various attempts to organize a branch for the «display element,» legislation created, in 1899, the Red Men's League, with a uniform resembling the «Continental,» and a perfect military code. Into this organization were merged prior uniformed bodies and beneficial councils. The adoption of consistent laws at once secured a continued increase in this branch of the Improved Order of Red Men.

Ritual.— The ceremonies of the Order are purely American. The ritual stands, and must ever stand, unique and distinct, growing more valuable as the only realistic demonstration of those mystic ceremonies of the aborigines, which otherwise might fade into oblivion. Founded, as has been stated, on the manners, traditions and customs of the American Indian, it portrays an existence more fascinating the longer it is studied, and gives the keynote to those bursts of eloquence which were at once the wonder and the admiration of the early missionaries, and of which the renowned «Black Hawk» is a shining example. The work of the Order is divided into three sections or degrees — the Adoption, the Warrior's and Chief's — each of which illustrates a phase of the characteristics mentioned. The degrees of the auxiliary branches of the Order are written in harmony with the general theme of the original ritual.

Nomenclature.— The attention arrested by the recital of this Order's official life is greatly enhanced when its terminology is considered. The expressions used not only differentiate the Improved Order of Red Men from other civic societies,. but these form links connecting it with prior organizations of Red Men. This is further outlined in the «history» following. Time is not computed as in the common era, but according to a phraseology that has a hidden meaning and significance to the «initiated.» Up to 1865, the Jewish style, namely, the year of the world, was used in dating documents. This was superseded by a revised system and «G. S. D.,» or Great Sun of Discovery, was adopted, the year 1492 being considered G. S. D. 1. For convenience the year begins with that of the common era, and the enumeration follows: A year, *Great Sun;* a month, *Moon;* January, *Cold Moon;* February, *Snow Moon;* March, *Worm Moon;* April, *Plant Moon;* May, *Flower Moon;* June, *Hot Moon;* July, *Buck Moon;* August, *Sturgeon Moon;* September, *Corn Moon;* October, *Traveling Moon;* November, *Beaver Moon;* December, *Hunting Moon;* a week, *seven suns;* a day is a *sun,* and a night is a *sleep.* Morning is called the *rising of the sun;* evening, *setting of the sun;* noon, *high sun;* midnight, *low sun;* an hour is a *run,* and a minute a *breath.* Examples: 30 July 1903 A.D. would be expressed as «30th Sun, Buck Moon, G. S. D. 412,» 1903 — 1491 = 412. «Tribes . . . shall, within two seven suns after the last council sleep in Hot and Hunting moons, transmit,» etc. Wampum Belt signifies treasury, and wampum or money is computed as follows: *Fathom,* one dollar; *foot,* a dime and an *inch* is one cent. To illustrate: «In case the wampum shall at any time be reduced to a less amount than five feet for each member, or to less than 50 fathoms, the tribe,» etc. Non-members are called *pale faces;* tribal jurisdictions are *hunting grounds;* Great Councils govern *reservations;* opening and closing meetings consist of *kindling* and *quenching council fires;* minutes are called *records;* addresses or reports, *talks* or *long talks;* attending to business is *following the hunt,* and wronging another, *crossing the path. Wigwam* and *tepee* signify the halls of meeting, and *council chambers,* a room therein. Voting is called *twigging.*

History.—An attempt has been made to establish a succession from the patriotic societies of the American Revolution to the Improved Order of Red Men, but without much historical basis. That such organizations, founded in 1763, existed, there is no doubt. Moreover, the War of 1812, with England, served to foster the assembling and banding together of men fired with patriotic ardor. It is quite likely these associations may have led to the formation of the societies of Red Men — possessing the terminology hereinbefore mentioned,— known to have flourished between the years 1813 and 1830, of which fragmentary records have been preserved. The impulse also may have come from the Tammany societies of the national period prior to 1812. A society of Red Men existed in Philadelphia, Pa., in 1824, and there were branches in other cities and States at earlier and later dates; but the movement, which began in Baltimore, Md., in 1833–34, really seems to be the authentic date of foundation. The Improved Order of Red Men was anti-convivial in its character, and was first brought into public prominence by the observance of Saint Tammany's Day (still on the calendar), 12 May 1837. The Order spread, and, on 20 May 1835, the Great Council of Maryland was instituted, and soon became an incorporated body. On 30 Jan. 1847 the Great Council of the

United States was formed as the supreme government, and this, in turn, became a corporation, by special charter from the legislature of Pennsylvania, approved 30 March 1866. The policy of the Order has been to possess a legal standing in the State; and a brotherly hand extended early secured the adherence of the scattered bands of Red Men to the «improved» institution, so that unity of effort soon promised much for the future. The fortunes of the «Improved Order,» however, were fluctuating at first, and, until 1881, when it began to assume its present proud proportions of over 479,000 members, embracing the entire republic, and reservations in Canada, and disbursing annually in benefits over $1,649,800, and since organization over $34,612,000.

Consult 'Official History,' edited by Charles H. Litchman, revised by Charles C. Conly (1893–99), and 'Documentary History of New York'; 'Constitutions and Digest, I. O. R. M.'

H. L. Stillson,
Fraternity Historian.

IMPSONITE. A natural bitumen or asphalt closely resembling albertite but only slightly soluble in turpentine. Brittle and burns without fusing. Occurs in Nevada and Oklahoma.

IMPULSE. This is a term used in mechanics to designate the «time integral» of a force. If the force is constant, the impulse it produces in a given time is the product of the force and the time in question. If the force is variable, its time of action may be divided into an infinite number of equal intervals. Then the impulse will be the sum of the products of each variable value of the force by the common infinitesimal time interval just defined. Impulse is a quantity of the same kind as momentum; that is, it is the product of mass and linear velocity.

It should be observed that in the case of impulses in nature the forces are never infinite and their times of action never infinitesimal, though it is sometimes convenient to adopt these fictions in analysis. (See Dynamics; Force). Consult Thomson and Tait's 'Natural Philosophy' (Part I), and Gray, A., and J. G., 'Treatise on Dynamics' (London 1911).

IMPUTATION, as a term in Protestant theology, is used to signify three things, first, the imputation of the sin of Adam to all of his posterity, second, the reckoning of the sins of man to Christ, third, the reckoning of the righteousness of Christ to believers. Thus, on the theory of imputation the sin of Adam is so attributed to each individual of the human race as to be considered in the Divine counsels as the act of that individual, who is thus rendered guilty of it. When sin is spoken of as imputed to Christ it is meant that the condition or state which was actually man's becomes by imputation judicially his, and thus in law Christ became fitted to be a sacrifice and sin offering for man. Had he not been man's substitute by the imputation of sin he could not have become his substitute in the endurance of the penalty of sin. The two are inseparably connected. In the very same sense in which Christ was made sin men are made the righteousness of God in him. According to this view he was made sin, not actually and personally, but by imputation; and men are made righteousness, not actually and personally, but by imputation. Consult Broughton, L. G., 'Salvation and the Old Theology' (New York 1908).

IMUS, ē'moos, Philippines, pueblo of the province of Cavite, Luzon, eight miles southeast of Cavite, the provincial capital; it is an important road centre. In 1896 it was the stronghold of the insurrection, Aguinaldo and other chiefs having their headquarters in its principal building. Pop. about 15,000.

IN-BREEDING, Evils of. See Breeding.

IN CŒNA DOMINI, ĭn sē'nä dom'ĭ ni, a papal bull, so called from its first words, it being annually read «at the Lord's Supper» on Holy Thursday. Its earliest form was that promulgated in 1363 by Urban V against all heretics and favorers of heretics. The bull was annually promulgated at Rome till the year 1770, when a much modified document took its place, this in its turn being withdrawn by Pius IX in 1869.

IN FORMA PAUPERIS (in the form of a pauper), legal term applied to a person who obtains leave to carry on an action at law without paying the fees of court and other costs.

IN MEMORIAM. 'In Memoriam' by Tennyson is one of the great elegies of the English language. 'Lycidas' and 'Adonais' would probably both come to mind in comparison, but neither is so widely known, nor does either answer so exactly to the spirit of the 19th century. 'In Memoriam' expresses the grief of the poet over the death of an early friend, but with the expressions of personal grief there is also an interpretation of the problems of death and the future life. The poet himself said: «This is a poem, not an actual biography. 'I' is not always the author speaking of himself, but the voice of the human race speaking through him.» Beside his own personal feeling, then, Tennyson in his poem gives voice to the sentiment of his time on Death and Immortality,— and in this effort he was remarkably successful. So capable a judge as F. W. Robertson said: «To my mind and heart the most satisfactory things that have ever been said of the future state are contained in this poem.» Many other such opinions might be quoted. F. D. Maurice thought that the author had made a definite step toward the unification of the highest religion and philosophy with the progressive science of the day. Henry Sidgwick subsequently wrote of certain stanzas: «I feel in them the indestructible and inalienable minimum of faith which humanity cannot give up because it is necessary for life.» Such opinions probably would not prevail to-day on the part of liberal and radical thinkers, but they serve to show how actually Tennyson's poem was something more than an expression of individual feeling. It expressed a very general sentiment of the race. This depth of thought comes in part from the fact that the poem was not written all at one time (like Browning's 'La Saisiaz' a little later) but was gathered together in the course of 17 years. Arthur Hallam had been Tennyson's closest intimate at Cambridge and in following years. In 1833 while traveling on the Continent he died. The poem presents a development of thought and emotion from the first passionate despair to the matured wisdom that sometimes comes with time. Four different stages are clearly shown by the three sets of stanzas describing the celebration of three returns of Christmas. The poem presents what has been called the «The Way of the Soul» (A. C. Bradley),— a passing from the first stupor and confusion of grief, through a growing acquiescence often disturbed by the recurrence of pain, to an almost unclouded peace and joy. The following main divisions are generally marked: (I) Absorption in grief; (II) Reflection on the idea of continued life and an advance from mere sorrow; (III) Resignation and Faith; (IV) Awakening of a new sentiment of the possibilities of life. The poem however is not chiefly noteworthy for thoughts which might have been expressed in prose. The ideas are themselves poetical, namely, the plain conceptions of philosophy on life transfused with imagination. The poem gives not so much argument as a way of thinking and feeling. The particular poetic expression is in a stanza-form which had been rarely used before, but which Tennyson in this poem made his own and indeed believed that he had invented. The stanza-form is such a slight variation from a very common one that it seems remarkable that no one should have used it before, but it is so absolutely the right thing in ‘In Memoriam’ that it is practically a real creation of Tennyson's. There are several commentaries on ‘In Memoriam,’ especially those by A. C. Bradley and John F. Genung. In Vol. I, Chapter 14 of the ‘Life’ by Tennyson's son will be found the chief authoritative facts concerning the poem.

EDWARD EVERETT HALE.

IN OLE VIRGINIA, a collection of negro dialect stories published by Thomas Nelson Page in 1887, is a revelation of the life of the ante-bellum South as it was found in the best homes of Virginia. It is not the whole truth with regard to slavery, but it suggests the social atmosphere of the somewhat feudal state of society as it existed among the better classes of Virginia. The medium through which this social life is revealed is the old-time negro as he looks somewhat wistfully back to the good old times when the relations between the races were kindly and gentle. Through the mists of the years he recalls in picturesque words the Southern colonel; the younger, more light-hearted young men, who threw themselves almost recklessly into the festivities and duelling of that era, and later became the most dashing and indomitable soldiers of modern times; the various types of Southern girls — the light-hearted, tender Polly, or Miss Charlotte «comin' down de grand stairway, lookin' like she done come right down from de top of de blue sky and bring a piece of it wid her,» or Meh Lady in her bridal dress, «white as snow from her head to way back down on de floh behine her, and her veil done fall roun' her like white mist, and some roses in her hair.» These types, all presided over by the dignified matron of the plantation — the gentle, classic, serious mother — are seen participating in fox-hunts, tournaments, weddings, harvest festivals, and above all the Christmas celebrations that have made Virginia social life famous throughout the world. Always in the background is the stately colonial mansion with its polished halls, grand stairways and noble porticoes. In «Unc' Edinburgh Drownin'» we hear the infectious music of the banjos, the laughter of the dancers, the festive noise and merriment of the cabin and the mansion. In some of the stories, notably in «Marse Chan,» we see the breaking up of the old order and the tragedy of the Civil War.

EDWIN MIMS.

IN PARTIBUS INFIDELIUM («in the regions of the unbelievers»). Titular bishops of the Catholic Church since the 13th century until 1881 were styled *episcopi in partibus, etc.* At first they were bishops without a diocese, and their titles were derived from places where there was no longer a bishop's see. The usage originated after the Greek schism, and became general in the time of the Crusades. The places conquered by the Crusaders in the East were furnished with Catholic bishops; but when these conquests were again lost the popes continued to appoint and consecrate the bishops to whom a special field of labor could not be assigned in Europe. Hence coadjutors and missionary bishops were consecrated to titular sees. Upon the re-establishment of the Catholic hierarchy in England in 1850, English bishops ceased being termed bishops *in partibus*. The term was abandoned in 1881 by order of Leo XIII, because many of these ancient sees had become the territory of Christian nations, rendering the old term inappropriate. It is now usual to term prelates consecrated to distant sees titular bishops.

IN PERSONAM, spoken of legal rights, means such as are maintainable only against a specific person and not against the whole world. (See IN REM). Rights *in personam* arise out of a specific engagement between individuals, or out of domestic or fiduciary relations.. But the majority of rights *in personam* spring from the violation of rights either *in rem* or *in personam*. A right once violated, a right of action against the violator immediately arises. An action brought against the violator is also called an action *in personam*.

IN REM, spoken of legal rights, means such rights as are not only maintainable against a specific person (see IN PERSONAM), but can be maintained against the whole world. Nor are rights *in rem* limited to property rights, but include all rights, such as freedom from personal assault, from causeless imprisonment, from trespass. The term includes the right not only of suing for damages, but of seizing and detaining certain articles. In admiralty practice this is a common resort, though in ordinary processes for the recovery of land or goods, it is rarely made use of nowadays.

IN THE TENNESSEE MOUNTAINS, a collection of short stories published in 1884 by Charles Egbert Craddock (Mary N. Murfree), reveals and interprets the primitive and elemental types of character to be found in the mountains of East Tennessee and western North Carolina. Many years before the Southern people had awakened to the undeveloped human resources in these mountains, the author, who had been in the habit of spending her summers in the Cumberland Mountains, felt and depicted the humor, the pathos, the kindliness and tragedy of these contemporary ancestors — men and women, who in their mountain coves had let the tides of civilization sweep on past them, leaving them in a state of arrested development. The more savage and the more gentle elements of their character are revealed at country stores, in blacksmiths' shops, at still-houses and in various forms of social life such as hunting, dancing, playing cards, political campaigns and religious revivals. If we have the blundering brutality and strength of ignorance, we have also the noble and tragic self-sacrifice of such women as Cynthia Ware, whose lover is saved by her devotion from his prison life only to pass out of her life and that of the mountains into the more material civilization of the valley; or Celia Shaw, who has a revelation of a life of culture as contrasted with her own crude family life only to be made aware that she cannot share it. Throughout the stories we are made to feel that «the grace of nature is in its way a fine thing; the best that art can do — the polish of a gentleman — is hardly equal to the best that nature can do in her higher moods.» As a background for these well-told stories there is always the presence of the mountains. Perhaps no American writer of fiction has surpassed Miss Murfree in descriptive writing. At times the art of interweaving the human story and the almost personal life of nature is perfect. At other times it is overdone. The best stories in the volume are 'Drifting Down Lost Creek,' 'A Star in the Valley' and 'Sledge at the Settlement.'

Edwin Mims.

IN THE VALLEY (1890), by Harold Frederic, is eminently representative of the historical novels which, during the later years of the 19th century in the United States, contended, for a time successfully, with the prevailing vogue of realism. As in so many stories of the type, the hero — a Mohawk Valley Dutchman — finds himself pitted against a brilliant villain — of course a British officer — who for a time wins the heroine — thrown among «Tories» and British but steadfastly loyal to her native colony — only in the end to lose her to the slow-witted though courageous and honorable Douw Mauverensen, who is historian as well as hero of the tale. The book adheres to the New York tradition, early set down in Irving and Cooper, of respect for Dutch prudence, suspicion of British perfidy and active prejudice against all New Englanders, particularly those from Connecticut. There are also faithful black slaves and ferocious Indians. So far 'In the Valley' accepts the conventions of its order, but it goes beyond them in other respects, for it lacks the customary tinsel of archaisms and pretensions, and is not always sentimental. Frederic, later distinguished by his energetic naturalism, was, in this romance, prophetically spare and terse. Years of preparation, he said, went to the making of the book, which is full of unobtrusive erudition regarding life in the Mohawk Valley and in Albany from 1757 to 1777, when the diverse nationalities of the region were drawing together into a common Americanism. For them it was both a civil and a foreign war; the battle of Oriskany, by checking the British and Indians, not only left the valley in the hands of the colonials but also prevented the junction of St. Leger and Burgoyne and so contributed to the decision reached at Saratoga. 'In the Valley,' compact and dramatic throughout, comes to its fitting climax with the fight at Oriskany.

Carl Van Doren.

INAGUA, ē-nä'gwä, **Great and Little**, two of the Bahama Islands in the West Indies, at the southern extremity of the group. Great Inagua has an area of 660 square miles, and Little Inagua 36 square miles. The largest town of Great Inagua is Matthew Town, and the entire population is not over 1,500.

INAJA (ĭn-äj'ą) **PALM**, a palm (*Maximiliana regia*), indigenous to the region of the Amazon, South America. It is noted for its strong stem which seldom exceeds 20 feet in height, and for its long drooping leaves which are often 15 feet long. Hunters use the spathes as cooking pots and the Indians as baskets and cradles. The fruits are eaten by the Indians, who also make hats and ropes from the fibres of the leaves.

INAUGURATION DAY. When the Constitution had been ratified by the requisite number of States the Continental Congress, by resolution of 13 Sept. 1788, set the first Wednesday of the following March (4 March 1789), as the «time for commencing proceedings» under the new form of government. Owing to delays of various kinds, such as difficulties of travel, etc., members of the first Congress were very slow to assemble in New York, and a quorum of both Houses was not obtained until 6 April. The counting of the electoral vote, the notification of Washington and his journey from Mount Vernon to New York took until 23 April, and his inauguration was set for 30 April. His term of office was, however, construed as having commenced on 4 March, the date set by the Continental Congress for the inauguration of the new government, and so it came to an end on 4 March 1793, although it lacked nearly two months of the four years provided for by the Constitution.

INCA, or YNCA, the name of a tribe of Peruvian Indians — not exclusively that of a royal family or caste, as has been commonly asserted. The members of this tribe sometimes called their war-chief «Cuzco,» meaning chief or lord of Cuzco, but probably more often «the royal Inca,» or simply «*the* Inca.» (Consult 'Royal Commentaries of the Yncas,' by Garcilasso de la Vega, Lisbon, 1699, Part I, chapters 8 and 15). The latter usage was in the end adopted by Spanish chroniclers; and Garcilasso, half Spaniard, half Indian, in the 15th chapter of his commentaries, which were written, he tells us, 71 years after the conquest, uses both the longer and the abbreviated forms —«Yncas Kings» and «Yncas»— though feeling that he must explain that he means by the latter the «native kings of Peru.» Throughout the tribe mother-right prevailed, and marriages were contracted between members of different clans; therefore offices could not descend from father to son; and especially the office of war-chief, or Inca par excellence, must usually have been filled by selection. The tribal dialect was called Quichua. See also Peru.

INCA SEMI-CIVILIZATION, the state of advancement in arts and learning reached by the most progressive tribe of South American Indians, occupying a portion of the Andean Sierra, and exercising control, in the regions now known as Peru, Ecuador and northwestern Bolivia, over many other tribes of the highlands and lowlands before the Spanish conquest.

In the articles INCA, CUZCO and PERU, reference has been made to certain popular misconceptions touching Inca government, chronology and the tribal name. It is necessary to add that the evidence at present available is entirely insufficient to warrant such assertions as the following, which occurs in one of the leading works of reference: «The Inca was the absolute but, in most cases, *kindly* ruler. . . . In many respects the Inca government will compare favorably with any which at that time existed in Europe»; or this, from a popular account published in December 1903: «The Inca race had developed in pre-Columbian times an astonishing and marvelous civilization.» Far from lending itself to such conclusions, the evidence furnished by Spanish writers of the 16th and 17th centuries, when their works are tested and corrected by a comparison with the results of modern archæological research, points to social conditions which cannot be ranked above semi-civilization. Moreover the objects collected by archæologists to illustrate or represent industrial and artistic activity in ancient Peru in point of fact illustrate and represent the activities of a race very slightly elevated above semi-barbarism. In the customary treatment of their dead a lack of higher symbolism made itself felt oppressively; the crouched position of the body, bound in a tawdry pack, and the commonplace offerings buried with it suggested nothing better than the petty comforts, or ignoble miseries, of a life forever limited to alternating phases of servile toil, crouching rest, sensual indulgence and childish diversions. The various tribes of the Sierra, from Quito to Lake Titicaca, were bound together by roads which ran from one highland village to another; the lowland Indians were held in subjection through fear alone, the Inca supremacy signifying to them a prolonged reign of terror.

Some of the war-chiefs may have been «kindly rulers»; we shall, in all probability, never know whether they were or not. Cristoval de Molina, who described the «Fables and Rites of the Yncas,» and who, in order to gain the knowledge of those rites which he imparts, «assembled a number of aged persons who had seen and participated in them in the days of Huayne Ccapac,» believed that some definite, if scanty, records existed. He says: «It is so that these people had no knowledge of writing, but in a house of the sun called Poquen Cancha, which is near Cuzco, they had the life of each one of the Yncas, with the lands they conquered, *painted with figures* on certain boards.» Another chronicler, Juan de Santa Cruz, who wrote about 1620, says: «I affirm that I have heard, from a child, the most ancient traditions and histories, the fables and barbarism of the heathen times.» Such as these are the sources of our knowledge of the story of the Inca rulers. Some of the events in the lives of the war-chiefs were depicted, as valuable records or as parts of an ornamental design, in a «house of the sun»; otherwise all rests upon the prattle of Indian dotards and of Indian nurses. Accounts written by the conquerors themselves (for example, Xeres) leave almost everything to the imagination. We may be certain, at least, that tradition retained most accurately the traits of the last two or three native chiefs, whom the «aged persons had seen»; and though we may not condemn the unknown by reason of the credibly reported misconduct of the known, we shall be obliged to suspend judgment, instead of accepting the easy platitudes now current with respect to the succession of war-chiefs from Manco down to Huayna. The shameless private life of Huayna Ccapac is set forth in the 'Antiquities of Peru' by Juan de Santa Cruz. As for that great war-chief's still more famous son, we read in Garcilasso de la Vega's 'Royal Commentaries of the Yncas' (Book IX, Chapters 35–37) that Atahualpa summoned all Incas of the blood royal to assemble at Cuzco, and put them to death. «The cruelty of Atahualpa,» says this historian, himself half Inca, «was greater than that of the Turks, for, not content with the blood of his own 200 brothers, the sons of the great Huayna Ccapac, he passed on to drink that of his nephews, uncles and other relations . . . so that none of the blood royal might escape, whether legitimate or bastard. They were all murdered in different ways.» The same fate was meted out to all the loyal captains of his rival Huascar; furthermore «he ordered all the women and children [of royal blood] to be assembled, of whatever age and condition, reserving only those who were dedicated to the sun in the convent of Cuzco. He ordered that they should be killed outside the city, by little and little, and by various cruel tortures, so that they might be long in dying.» The varieties of ingenious tortures mentioned by Garcilasso are similar to those inflicted by North American aborigines upon captive women and children and «though the work could have been done in a shorter time, they prolonged it in order to enjoy the cruelties more fully.»

It appears to be altogether improbable that the Inca semi-civilization, if it had not been interrupted by the coming of the Spaniards, would have reached the height of 16th or 17th century European civilization, or by native merit have kept abreast of the advancing nations of the Old World. That the tribe had neglected to provide itself with a written language, and failed to develop high ideals in art, we have already noticed. A third essential for progress was equally wanting: the Incas had no money, or any medium of exchange corresponding to the wampum of the Indians who lived near the North Atlantic coast. But it is impossible for any people deprived of trustworthy records of human experience to construct a convincing system of morality; and without some convenient medium of exchange an extensive and pacific commerce is equally impossible. Both deductive and inductive methods of reasoning must, therefore, lead an unbiased student of old Peruvian institutions to the conclusions that, at home, inveterate and fully sanctioned practices made for degeneration; while steady blackmail, varied by occasional slave-raids, took the place of mutually beneficial dealings with neighboring, subject or independent tribes.

Limitations of the race's genius or experience may be exemplified in the department of music. The Inca musicians used drums which «were made by stretching a skin over a hoop of wood or over one end of a short section of the trunk of a tree which had been hollowed out to a thin cylinder.» (Compare 'The Musical Instruments of the Incas,› by Charles W. Mead, assistant Department of Archæology, American Museum of Natural History). Other musical instruments of percussion in common use were copper bells, in form resembling sleigh-bells; rattles, made of small shells, gourds and nuts, often strung together and attached to the wrists, ankles or other parts of the body, in dancing; also cymbals of rudimentary form. Wind instruments were the syrinx or pan-pipe, consisting of reeds of graduated lengths, held in position by a cross-piece of split cane lashed to the reeds with a cord made of llama wool — the reeds being sometimes closed at the lower end, sometimes open, and occasionally arranged in double rows, yielding octaves; flutes, made of cane or bone, «simply tubes, open throughout their length, and all belonging to the class known as ‹end-blown,›» not scientifically constructed and not attuned one to another; resonator whistles, emitting several different notes; trumpets, made either of terra cotta or of conch shells,— primitive instruments, producing only four or five distinct tones (as shown by actual test of specimens taken from the ancient tombs); a double musical water bottle, consisting of two pottery vessels connected near the bottom in such a way that water passes freely from one to the other, and in its passage (when the vessels are swung backward and forward) forces air through an opening near the top, producing a series of whistling sounds; and finally the «cornets» mentioned by Garcilasso (‹Royal Commentaries›) and Herrera — instruments formed like the oboe, rather than the cornet in the modern sense. With this enumeration the list is exhausted. Such evidence as we have at the present time disproves the existence in Peru of any form of stringed instrument before the coming of the Spaniards. In other words, the unaided genius of the Inca Indians, exerting itself in the field of music, stopped short of the more complex instruments: ancient Peruvians were satisfied with the wild discords evoked from pan-pipes, flutes (or fifes), drums or clashing shells, all of rude construction.

And, as in music a great volume of sound — not harmony — was the desideratum, so in architecture they neglected beauty and strove to attain resistant mass, with walls as solid and homogeneous as possible — the prime essentials in a country shaken by destructive earthquakes; and their solicitude in this respect suggests that the tribe, before the migration to which old legends refer, may have dwelt in the volcanic western part of the Sierra. (See PERU). Hence the so-called «cyclopean» walls of the temples and palaces, structures built to endure, for which the builders utilized enormous stones of irregular shapes, fitted together so skilfully that mortar was not required.

It is safe to say that nearly all features of the ancient industrial life of the tribes inhabiting the Andean Sierra and Peruvian coast strip are either intimated or plainly shown by specimens in the archæological collections of the United States and Europe. (See article ANCÓN). With the utmost care products which are not properly to be classified as Incan have been separated from those showing the activities of the dominant race; and such care is obviously indispensable, for the Incan objects do not stand out from the rest quite unmistakably. One finds practically nothing to support the theory that there was ever a nearly unrelated, or a wholly distinct and marvelously superior, Inca civilization. Especially instructive are the examples of the potter's art which have been secured in great numbers — representing such different social classes as the warrior, musician and water-carrier. Costumes, weapons, occupations, etc., are depicted faithfully, though without artistic charm. Fabrics of cotton, or woven from the wool of the llama, vicuña and alpaca; looms, spindles and colored threads, bear witness to the wide extension of the industry of weaving so often mentioned by early writers. Offerings made to the dead in the graves which have been discreetly rifled recall the fact that agriculture shared with warfare the distinction of being the chief occupation of able-bodied men. Inca women are shown to have been eminently domestic in their tastes and employments, ruling supreme in the house, taking no part in public affairs. Gold and silver appear to have been not less abundant — perhaps they were even more abundant — in the lowlands than in the highlands: at any rate vessels formed from the precious metals are found more commonly in the burial places near the coast. It is not to be supposed that the natives failed to appreciate the beauty and utility of silver, gold and copper. An ingrained preference for the clumsy methods of barter prevented them from adopting any medium of exchange or setting apart one or more of the metals to be used as «money.»

MARRION WILCOX.

INCANDESCENCE. See ELECTRIC LIGHTING.

INCANDESCENT GAS-LIGHT. See GAS ILLUMINATION.

INCANTATION (from Latin *incantare*, to enchant), a musical formula chanted, sung or monotoned, and supposed to create a magical or beneficial influence. The mother's crooning lullaby of all ages is a typical incantation to soothe the child to slumber. The use of incantation is found among all nations back to the earliest historical records. Akkadian spells of the ancient Chaldeans have been disclosed. Homer and Theocritus among Greeks, Virgil and Horace among Romans, give the poetical formulæ of incantations and they are found in Egyptian and Hindu literature. The Vedic *mantras* or incantations have their parallels in the Japanese *majinahi*, the Maori *karakias* and the *matamanik* of the North American Indians. In the British Isles, in Germany, in all European countries their traces are found in local folklore. See MAGIC.

INCAPACITY, *in law*, the state of being unable to incur either a civil or criminal liability. It may be due to several causes, such as the minority or infancy of a party, lunacy or drunkenness. It existed formerly to a certain degree in the case of married women, but has largely been removed by legislation. Children under seven years are presumed incapable of committing crime of any sort.

INCARNATION (from later Latin, *incarnatio*, first used by Irenæus, A.D. 180, derived from *in* and *carnem*, into flesh), the permanent assumption of human form or human nature by a divine personage. In the Christian religion, the incarnation signifies the assumption of human Nature by God in Jesus Christ. The classical statement is John i, 14, «And the Word became flesh, and tented among us.» This is the central teaching of the Christian religion, and the source of its claim to universal acceptance and to finality. Very intimately bound up with it, though distinguishable from it, are the important teachings of the divine sonship of Christ, his sinlessness, his pre-existence and virgin birth and inevitable deductions affecting the Trinity (q.v.) and the atonement (q.v.).

I. Sources in the New Testament.—(a) The gospels show how the disciples became convinced of the incarnation as a fact. The impression of the greatness of Christ's personality; his miracles, which showed his sovereign power over disease and nature; his sinlessness, proved not so much by express declaration and outward conduct as by a combination of the most penetrating ethical insight and moral power with an entire absence of any sense of sin or moral failure or need of forgiveness; the intimacy of his knowledge of God and communion with him; his claims that moral character and future salvation were decided by relation to himself; his assumption of authority to forgive sin, and his promises of rest to weary souls, who came to him; the experience of this forgiveness and rest in their own hearts — all predisposed the disciples to this belief. Yet the most powerful factor, taken in connection with the foregoing elements, was Jesus' claim to be the Messiah (q.v.), who had been prophesied in the Old Testament scriptures and was a familiar figure in the later current Jewish literature. This claim meant nothing less than that he would be the future judge of all men, the bringer of the supernatural kingdom of God, and king in that kingdom. This claim was acknowledged by Peter at Cæsarea Philippi with Christ's joyful approval, was constantly asserted by implications of more than human authority and by the use of the phrase, «Son of Man,» which means nothing more nor less than Messiah, and was maintained, although Christ knew that it would cost him his life, in reply to the High Priest's question in the trial before the Sanhedrin. The resurrection, however, decisively and forever settled the matter in the mind of the disciples. After that event, they had no further doubts. John's gospel truly represents the growth of their faith to the climax, when Thomas calls the risen Jesus, «My Lord and my God.»

(b) The early Church consequently proclaimed Jesus the Messiah, sitting not on David's throne, but at the right hand of God, and cited the resurrection as proof. They called Jesus Lord, using the very word used of Jehovah in the Septuagint, and in connections which exclude any other reference. The opening chapter of the earliest Pauline Epistle, 1 Thessalonians, associates God and Christ on terms of practical equality. 2 Cor. iv, 4, 6, and Col. i, 15 assert that Christ is the image of the invisible God, cf. 2 Cor. v, 19. 1 Cor. viii, 6 and Col. i, 16–18 make Christ the mediator of creation. 2 Cor. iii, 17 identifies him with the divine Spirit, and, according to the best modern expositors, Paul in Rom. ix, 5 calls him «God blessed forever.» The earliest epistles already show that the pre-existence of Christ is no new idea to be explained and enforced, but the common property of Christians, cf. Rom. viii, 3, 1 Cor. xv, 47, 2 Cor. viii, 9, Gal. iv, 4. These thoughts are developed at length in Phil. ii, 6–11 and Col. i, 15–20. The familiar and incidental reference to these teachings as matters of course in the belief of the Church dispose us to believe that they have their root in Christ's own declarations of pre-existence as recorded in John's gospel, John xvii, 5, 24; viii, 58; iii, 13; vi, 62, 33, 38; xvi, 28, etc. The other New Testament writers shared these views of Christ's pre-existence, cf. Heb. i, 1–3, and 1 John i, 1–4. The Prologue of John i, 1–18, is the climax of the development of the teaching in the New Testament.

Historically viewed then, the early Christians believed without any doubts in the incarnation on the basis of a synthesis of proofs derived from Christ's personality, his moral spotlessness and force, his miracles, his Messianic claims, his resurrection and their own experience of his forgiving and renewing power, and not on the basis of the virgin birth, which is never mentioned outside the opening chapters of Luke and Matthew. This teaching, however, was welcomed by men, who believed the fact of the incarnation, as an explanation of its method, and is accepted by most believers to-day in the same relation. It is therefore not essential to the teaching of the incarnation, which might have taken place in other ways, but is the gospel-given history of the method adopted by God to bring the incarnation about, and, logically considered, it is burdened by no more difficulties than any other possible method would probably be. It does not appear improbable to those who already believe in the incarnation. The historicity of the virgin birth has recently been keenly attacked on the most diverse grounds, principally by those who eliminate the supernatural. Its defenders are taking the position that though the reports of it were late in being disclosed, as shown by absence of mention of it in the rest of the New Testament, they are in fact the most archaic Christian documents. In support of this, they point to the Aramaic coloring of the narratives; their Hebrew background; their primitive Christian viewpoint; their simplicity, beauty and delicacy; the reasons which immediately suggest themselves why such a story should be withheld till Jewish opposition had decreased, and the principal actors had passed from the stage; and their inexplicability on any other hypothesis than their truth.

II. The Church Doctrine.— The New Testament fails to give any answer to the questions of the exact relationship of Father, Son and Holy Spirit, and of the manner in which the divine and the human in Christ were related to each other, and these matters formed the subject of the first great theological controversy, during which the teaching of the incarnation was defined and developed principally in opposition to misapprehensions of it by different parties and individuals within the Church.

(a) The earliest were the nearly opposite errors, Ebionitism (see Ebionites) and Docetism (see Docetæ), both of which began in the 1st century and flourished during the 2d. The Ebionites were a sect of Jewish Christians who held that Jesus was naturally born, was merely a prophet, received an extraordinary endowment of the Spirit at his baptism, and was finally exalted to Lordship at his resurrection. It was merely Judaism in semi-Christian dress; against it the Fathers asserted the full teaching of the incarnation, and it soon passed away.

(b) Gnosticism (q.v.), which started with the assumption of the inherent evil of matter, almost necessarily drifted into Docetism, the doctrine that Christ could have no real relation to matter, that his body was merely apparent, a vision and delusion, or at least of a spiritual nature different from a human body, and not subject to suffering and death. This view was held in different forms and was shared also by Manichæism. (See MANICHÆANS). It is a practical denial of the possibility of the union of the divine and the human. Docetism was very early. It seems to be opposed in 1 John iv, 2, and 2 John vii. The apocryphal Gospel of Peter, discovered in 1886, is Docetic. It was attacked by Ignatius. The fathers met it by an insistence on the real humanity of Christ. After large influence, it passed away with Gnosticism. Justin Martyr, Irenæus, Clement of Alexandria, Origen and Tertullian were the principal theologians who defended and developed the teaching of the Church during this period.

(c) With Sabellianism (see MONARCHIANS, SABELLIUS) condemned in 262, began the real contest. Sabellius urged that the Trinity is not a trinity of persons in one substance, but merely three different or successive forms of the revelation of the one person. Christ was pre-existent because the one person persisted under the change of revelation-form. The Patripassians were Sabellians, who logically asserted that it was the Father who suffered on the cross. Sabellianism, variously modified, has constantly reappeared, and is now known as the doctrine of a modal Trinity. The controversy with Sabellianism did much to sharpen the definition of the Church.

(d) The greatest battle over the teaching of the incarnation was brought on by Arius (see ARIANISM; ARIUS), a presbyter of Alexandria, about 318. Arius held that Christ was a pre-existent divine being, but of a different essence from the Father (heteroousios), created by the Father out of nothing but himself the creator of the world, and the incarnate Saviour. The Semi-Arians taught that Christ was not of a different essence from the Father, nor, as the orthodox asserted, of the same essence (homoousios), but of a similar essence (homoiousios). This was a very elastic and ambiguous view. The great defenders of the coequality of the Son and the Father were Athanasius (q.v.), the father of orthodoxy, at one time called, «Athanasius versus mundum,» Basil, Gregory of Nazianzen and Gregory of Nyssa (qq.v.). The whole Christian world rang with the contest, which culminated, but did not end, with the decision of the Council of Nicæa, the first œcumenical council, in 325 A.D., in these words, «We believe in one God, the Father Almighty, maker of all things visible and invisible. And in one Lord Jesus Christ, the Son of God, begotten of the Father (the only-begotten, that is, of the essence of the Father, God of God), Light of Light, very God of very God, begotten not made, being of one substance (homoousios) with the Father; by whom all things were made (both in heaven and in earth); who for us men, and for our salvation, came down and was incarnate and was made man; he suffered, and the third day he rose again, ascended into heaven; from thence he shall come and judge the quick and the dead.» After a renewed struggle, this creed, slightly enlarged, was reasserted at the second œcumenical council at Constantinople, 381 A.D.

(e) Apollinarianism (see APOLLINARIANS), as well as Arianism, was condemned at this latter council. It was a reaction against Arianism, and taught that Christ had a human body and animal life, but that the pre-existent Logos took the place in Him of the human mind and spirit. Against this extreme, the Church protested that Christ had a real human soul as well as a real human body.

(f) Nestorius (q.v), bishop of Constantinople, objected to calling Mary «the mother of God.» This position led him, however, to join the human and divine in Christ so loosely that he was accused, probably unjustly, of giving Christ not only two natures but making Him two persons, at best a man inhabited by God. He was irregularly deposed at Ephesus in 431 A.D., but the verdict was generally accepted that the Church must insist on two natures vitally united in one person.

(g) The opposite extreme was attempted about 448 by Eutyches (q.v.), an abbot of Constantinople. He maintained that Christ had only one nature, a fusion of the human and divine, and something different from either. This period of controversy was closed by the celebrated formula of the Council of Chalcedon (see CHALCEDON) 451 A.D. as follows: «We, then, following the Holy Fathers, all with one consent, teach men to confess one and the same Son, our Lord Jesus Christ, the same perfect in Godhead and also perfect in manhood: truly God and truly man, of a reasonable (rational) soul and body; consubstantial (coessential) with the Father according to the Godhead, and consubstantial with us according to the Manhood; in all things like unto us, without sin; begotten before all ages of the Father according to the Godhead, and in these latter days, for us and for our salvation, born of the Virgin Mary, the Mother of God, according to the Manhood; one and the same Christ, Son, Lord, Only-begotten, to be acknowledged in two natures, *inconfusedly, unchangeably, indivisibly, inseparably;* the distinction of natures being by no means taken away by the union but rather the property of each nature being preserved, and concurring in one Person and one Subsistence, not parted or divided into two persons, but one and the same Son, and only begotten, God the Word, the Lord Jesus Christ; as the prophets from the beginning (have declared) concerning him, and the Lord Jesus Christ himself has taught us, and the Creed of the Holy Fathers has handed down to us.» This declaration has ever since been considered by the strictly orthodox the limit of human wisdom on this subject.

(h) Still it did not immediately end the controversy. Eutychianism revived in Monophysitism (see MONOPHYSITES), or the doctrine of one nature in Christ, which convulsed the Eastern Empire for more than a century; while its corollary, Monotheletism (see Monothelites), the doctrine that Christ had one will, unfortunately induced the Church in the sixth œcumenical council at Constantinople in 689 A.D. to assert that will belongs to nature rather than to person, that consequently Christ had two wills, never at variance. This completed the orthodox statement.

III. Modern Views.— Since the Chalcedonian formula (see g above) followed the lines recommended by Pope Leo I, it was accepted by the Western Church, although it subsequently fell somewhat into the background before the development of the idea of the Church as the body of Christ. Briefly, though the incarnation was discussed in the Middle Ages, no progress was made, and the great Reformed Churches made, and still make, their Christological declarations on the basis of the Chalcedonian formula.

(a) While the great creeds and the great mass of the Christian Church still rest here, many modern Protestant scholars insist on re-examining this great central doctrine as they do all others, seeking a restatement more in accordance with modern points of view. There is an inclination, on the one hand, to magnify the incarnation as the great specifically Christian doctrine, and on the other, to object to the ancient definition of it as too fine-spun and metaphysical, going beyond what it is given men to know. These scholars insist on a revaluation of the Scripture statements and the historical facts on which the doctrine is based, especially on giving to the fact of Christ's growth in knowledge and wisdom, and to his true humanity generally, its proper weight, on proceeding on the lines of history and ethics rather than on the lines of metaphysics. Many deem the ancient formulas full of bad psychology and impossible philosophy, and demand a restatement in line with the progress of human thought in other departments of knowledge. Many even of these, however, would agree that the general results of the earlier contest must be preserved as the expression of the universal faith of believers from the apostolic age to the present.

(b) The first of these attempts was made by the Socinians (see Socinus) in Poland in the 16th century. They rejected the Trinity, and held Christ to be not divine, but more than a mere man, in that he was conceived of a virgin, was absolutely holy and was finally exalted to absolute power. The Socinians gave birth to the modern Unitarians (q.v.), who reject the deity of Christ, and in varying degrees look on him as the ideal of humanity, "the best we know," or, at least, as one of the prophets. This shades off into

(c) Pantheistic conceptions, to which Hegel gave a powerful impulse. There is an essential unity of the human and divine; humanity is itself divine. The pre-eminence of Jesus is seen in that he first awoke to the consciousness of this fact, and represents it in its purest and strongest form. The great body of Christian believers fail to find in the Unitarian or pantheistic statements a sufficient explanation of the Christ of history and experience.

(d) The Kenotic theories propounded by Thomasius, Gess and Martensen, have a more orthodox origin and result. They are based on Phil. ii, 6–8, especially the words "he emptied himself" (ekenosen), and are inspired by the desire to present the full human development of Christ. The Kenotists in varying degrees declare that the pre-existent Christ at the incarnation divested himself of the attributes of omnipotence, omniscience and omnipresence, and *became* man, retaining, however, the essential attributes of truth, holiness and love. By thus depotentiating the divine nature to the level of the capacity of the human, it was hoped to overcome the dualism of the ancient statement. These theories have had wide influence, but are severely criticised as metaphysically impossible.

(e) A theory of gradual or progressive incarnation was matured by Dorner (q.v.). There is no self-limitation of the pre-existent Logos, but a limitation of his self-communication to the human nature. Jesus Christ progressively became conscious of his divine nature and realized it fully only at the resurrection. Christ became conscious of his Godhood just as He became conscious of his manhood. Its opponents hold that this theory is Nestorianism in a more subtle form and does not really do away with dualism.

(f) The present dominant German theological school, the Ritschlian (see Ritschl, Albrecht), follows a new method of procedure. Instead of beginning to discuss the incarnation with a consideration of the self-witness of Jesus or of the apostolic testimony, it begins with the Christian's experimental knowledge of Christ as Redeemer, and consequently asserts that none but the possessor of a Christian experience can have any real knowledge of his person. What the believer has learned of Christ in his experience leads him to call Jesus God, for none but God can do for the believer what Jesus has done. Christ is the full and perfect revelation of God in His Grace and truth: Christ's will, too, is the will of God, namely, the establishment of the kingdom of God, and to found this was Christ's unique vocation in the world, a vocation to which He was absolutely true; in all his life and sufferings He was absolutely independent of and superior to the world, and so gained unlimited sovereignty over it. But if we meet God in Christ so as to *experience* the divine power and presence, God himself must be in Christ and in some true sense Christ must be God. How this can be is a matter of metaphysics which is insoluble and does not concern us. Ritschlianism thus attempts to prove the deity of Christ from experience, and to free Christianity from the entanglement of metaphysics on the one hand, and make it independent of the results of biblical criticism on the other. From such a viewpoint, it regards the doctrine of the two natures as a hindrance, and the virgin birth as a matter of indifference, something to be decided on the grounds of historical criticism. The tendency of the leading living theologians of the school is toward a personal pre-existence, and some form of the doctrine of the Trinity. Kaftan declares that "Christ's historical person stands in a connection of nature with God which is altogether unique and can never be repeated." Consult Garvie, 'The Ritschlian Theology,' Chap. 9.

(g) The modern conceptions of the universe, and especially of evolution, have had their influence on the modern belief in the incarnation. (1) In many different schools of thought, the idea gains currency that the incarnation was an ethical, not a metaphysical, necessity of God's nature, a necessity of His love and grace, and would have occurred in some form, even if sin had never entered the world. The incarnation was no afterthought to repair an unforeseen calamity, but has its place in the eternal purpose of God alongside of and conditioning the plan of creation which made sinning possible. (2) Theistic evolution suggests not only that Christ is the consummate flower of the race, "the end and goal of the whole ascent of life, the perfect man beyond whom there can be none higher," but that this perfect man is raised to the throne of divinity. (3) It is also seen that the finality of the Christian religion can be guaranteed only on the ground of the deity of Jesus Christ; for if Christ was one like us, however superior to all who have yet existed, there is no certainty but that during the ages another may arise superior to Him. The incarnation is thus the central doctrine of Christianity, and its maintenance in some form or other is vital to its existence. See also CHRISTOLOGY.

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INCE-IN-MAKERFIELD, England, a town of Lancashire, southeast of Wigan, on the Leeds and Liverpool Canal. It has large collieries, forges, iron foundries, cotton mills and railroad car shops. The water-supply system is owned by the municipality. Pop. 22,000.

INCENDIARISM, or **ARSON** (from Lat. *incendere,* to set on fire), the criminal malicious voluntary burning of the property of another. In common law the term is confined to the burning of houses or buildings of whatever kind. In Roman law the penalty of death was provided for the incendiary; and in all civilized countries provisions have been made for the severe punishment of criminals of this class. The Saxon law of England also provided the death penalty for incendiarism; and even as late as the reign of King John the law remained, in this respect, unchanged. In Saxon times, and probably even later, the sentence of the court was carried out by burning, and later by hanging. Under the Tudors, any one convicted of incendiarism was deprived of the right of clergy, and even in particular cases was held to have committed high treason. The English Malicious Damage Act of 1861 defined as incendiarism (and as such, felonies), the setting fire to any church, chapel, meeting-house or place of divine worship, to a dwelling-house, any person being therein, to a house, outhouse, manufactory, farm buildings or any other similar building, with the intention of defrauding any one; to buildings belonging to railways, ports, docks or harbors; or any public building. Any one convicted of any one of these crimes may be imprisoned for life, or for a shorter term, not however less than three years. The burning of grain fields comes under this act and provides for punishment of the same sort, not to exceed 14 years' imprisonment at hard labor; but the penal servitude may be for life in case of the setting fire to peat or coal or stacks, provisions or stores of straw, grain and like products, at the discretion of the court; while if the coal be in mines, the extreme penalty is 14 years. Death is the penalty provided for maliciously and wilfully setting fire to government ships, docks, magazines, arsenals, ammunition stores or buildings connected therewith. Other vessels, stores, and so forth, come under the Malicious Damage Act already mentioned. The laws against incendiarism in the United States are very much the same as those in England; but each State has its own regulations on the subject. The death penalty is provided only in case death results from the crime, in which case the criminal is prosecuted not for incendiarism, but for murder. In general, the laws of all of the States provide that something must actually be burned before the crime of arson may be charged. In the United States it is, in most States, not considered incendiarism or arson to burn one's own property even when it is clearly proved that the act was done with the intention of defrauding an insurance company or other interested party, or to get rid of goods or evidence. In this case special laws have been provided for the crime. But here again each State has its own particular laws on the subject. Consult Holdsworth, 'History of English Law' (London 1910); Pollock and Maitland, 'History of English Law' (Boston 1899); Russell, 'Treatise on Crimes and Misdemeanors' (London 1896); Stephen, 'Digest of the Criminal Law' (London 1894).

INCENSE, a mixture of gums, spices, etc., constituting an aromatic compound burned in religious rites of remembrance and giving off a sweet odor. The custom of burning incense is ancient and widely spread, its earliest purpose having been the fumigation and purification of the animal sacrifices and fruit offerings of the altar. Among the Jews the rite was later enjoined as part of the memorial worship of the sanctuary (Ex. xxx, 27), the ingredients of the incense also being laid down, and it was to be burned on a special altar called the altar of incense. This altar was made of acacia (shittim) wood, and was overlaid with gold, hence it was called the golden altar, as distinguished from the altar of burnt-offering, which was made of brass. The incense was burned daily — morning and evening. The early Christian Church is not recorded as burning incense, but it came into use about the 5th century. Its use was abandoned in the Church of England in the reign of Henry VIII, but was revived by the High Church party late in the 19th century. It has always formed part of the ritual of the Catholic Apostolic Church (q.v.) founded by Edward Irving in 1835. Both the Greek and the Latin churches use incense in worship. Among Catholics it is used at every high mass, at consecration of churches, in processions, funerals, etc. In Europe frankincense is commonly employed as incense, but in America the modern ingredients are usually benzoine, gum olibanum and styrax, and sometimes balsam and powdered bark of cascarilla. This mixture is allowed to fall on hot charcoal in the censer and burns promptly.

INCEST, *in law,* cohabitation or sexual intercourse between persons so related that they cannot legally marry. It is a punishable offense in the United States and many other countries. Although incest is not an offense by the common law, sexual intercourse or an attempt thereat between certain near relatives is punishable in England by statute, passed in 1908. Until 1887 it was punishable in Scotland by death, but the usual sentence was imprisonment for life.

INCH, James Robert, Canadian educator: b. Petersville, New Brunswick, 1835; d. 1912. He received his education at Mount Allison University and from 1864 to 1878 was principal of Mount Allison Ladies' College. From 1878 to 1891 he was president of the University of New Brunswick and also served as superintendent of education of New Brunswick. He was vice-president of the Dominion Educational Association in 1895. In 1906 he was prominent in the movement seeking to effect a union of the Congregationalists, Methodists and Presbyterians of Canada and in 1907 he took part in the Imperial Educational Conference at London. In 1909 he resigned the post of superintendent of education.

INCH, a lineal measure, the 12th part of a lineal foot, anciently said to consist of three barley corns. A statute of Edward II (1324) makes «three barley corns round and dry,» the definition of an inch. The English inch is equal to 2.54 centimeters. The old Scotch inch was slightly longer than the English. The ordinary divisions of an inch are halves, quarters, eights, etc.; the Romans divided them into twelfths. For micrometer measurements divisions into hundredths and thousandths are customary, ten-thousandths being about the limit. Reduced to centimeters the square inch is 6.4516, and the cubic inch 16.387.

INCH-WORM. See MEASURING-WORMS.

INCHBALD, Elizabeth Simpson, English actress, dramatist and novelist: b. Stanningfield, Suffolk, 15 Oct. 1753; d. London, 1 Aug. 1821. In 1772 she was married to an actor named Inchbald, and the same year went upon the stage. She retired from this profession in 1789 and devoted herself to literature. Some of her plays, which belong to the class of high comedy, still keep the stage, but her greatest success was the novel 'A Simple Story' (1791), which was translated into several languages. She also wrote 'Nature and Art,' and among her plays may be cited 'Such Things Are'; 'The Married Man'; 'The Wedding Day'; 'The Midnight Hour'; 'Every One Has His Fault'; and 'Lovers' Vows.' See A SIMPLE STORY.

INCHCAPE ROCK. See BELL ROCK.

INCHCOLM, ĭnch'kōm **(ISLE OF COLUMBIA),** Scotland, a small island in the Firth of Forth, off the coast of Fife, from which it is separated by a channel about one mile wide. The island is about 1,000 yards long by about 600 in width and is rich in ecclesiastical ruins, especially an abbey of the Canons of Saint Augustine, founded here in 1123. The monastery suffered greatly in the wars between England and Scotland. Consult Simpson, 'Æmona and the Islands of the Forth' (Edinburgh 1861).

INCINERATION. See CREMATION.

INCISED MEANDERS. See MEANDERS.

INCLINATION, Magnetic, or MAGNETIC DIP. See DIPPING NEEDLE.

INCLINED PLANE. The inclined plane is a mechanical device for overcoming a part of the weight in lifting or raising a heavy body. When the plane is level it supports or opposes the whole of the weight or attraction of gravitation exerted upon the body. As one end of the plane is raised the plane supports less and less of the weight, until, when the plane stands vertical, it supports none at all. To move a body up an inclined plane, and so raise it to a higher elevation, only such force is needed as to overcome that part of gravity which is not supported by the plane. Therefore the smaller the angle of elevation of the plane from the horizontal, the less power will be needed to move it up the plane, and the longer the plane will have to be to raise it to a given height; and, conversely, the steeper the plane, the more power must be used, but the quicker will the elevation be accomplished, and the shorter the plane required. The equation of the inclined plane is

$$\text{Power} \times \text{length} = \text{weight} \times \text{height}.$$

The principal of the inclined plane is most commonly and universally applied in the screw, which is no more than an inclined plane wrapped around a cylinder. Other applications are the cam and the wedge.

INCLOSURE, *in law,* the fencing in of common lands by the lord of the manor, by which he extinguishes the common rights. (See COMMONS). Consult Gonner, 'Common Land and Inclosure' (New York 1912).

INCO-ORDINATION, a lack of control over muscular movements. In inco-ordination there may be (1) some interruption in the paths of the motor impulses as sent from the motor areas in the brain to the muscle-centres in the spinal cord; or inco-ordination may result from (2) deficiency in the incoming sensory paths, thus causing an interference with the sense of muscular localization. One of the most familiar illustrations of inco-ordination is seen in acute alcoholism. In this condition the lack of motor control is largely due to interference in the conduction-paths of motor impulses. The intoxicated person is unable to control the movements of his hands to make them perform in their wonted fashion ordinary acts. In locomotor ataxia, a disease in which inco-ordination of the movements is very striking, the inco-ordination seems to result from a loss of muscle and joint sense, whereby the patient's mind is rendered unable accurately to realize just where his limbs are. Inco-ordination is a symptom of a number of different forms of poisoning, and is extremely characteristic in diseases such as locomotor ataxia, multiple sclerosis, chorea and paralysis agitans. It also characterizes a number of infantile diseases.

INCOMBUSTIBLE FABRICS, asbestos cloth or ordinary cloths immersed in tungstate of soda, phosphate or sulphate of ammonia, or silicate of soda, so as to render them fireproof. Such fabrics are used mostly for curtains and scenery in theatres and in most cities asbestos fire curtains are required in all theatres. Fire-proofing engineers, however, maintain that too much faith must not be placed in such materials as most of them lose their efficiency with the lapse of time after application. Consult 'Fire Tests with Textiles' (in 'Red Book No. 129,' issued by the British Fire Prevention Committee, 1908) and 'Fireproofing Cotton Goods' (in Vol. VI, No. 2, Quarterly of the National Fire Protection Association, Boston).

INCOME. Superficially, nothing seems easier to define than a man's income. It is the money which he has to spend in a given period of time, say a week, a month or a year. Fundamentally, however, few things are more difficult to define. A spendthrift may easily spend more than his income, thereby depleting the fund of wealth previously accumulated either by himself or by some one else and put into his possession. His real income would not exceed such a sum as he could spend without depleting its source. Many a small business man and many a small farmer, though not classified as spendthrifts, may easily spend more than their income by failing to allow for the depreciation of their capital or the depletion of their soil.

A business man, however, may allow one form of capital to depreciate by failing to replace it, preferring rather to spend the money which would be necessary for that purpose for some other form of equipment, thus maintaining the total amount of his capital intact. What he spends in order to maintain his capital cannot be considered as income. Similarly, a farmer may allow his soil to become slightly depleted, provided he spends the money which would be necessary to maintain it for some other form of equipment which then becomes a part of his capital. Many of our pioneer farmers found that method necessary in order to equip their farms with buildings, wells, fences, tools and live stock.

On the other hand, it is not uncommon for a man to live frugally and spend a part of his income, not for purposes of consumption, but for the purpose of adding to his capital. Such increments of capital are usually called parts of his income, but some prefer to call them sources of deferred income. If, for example, a man should save $1,000 out of this year's receipts and spend it for new equipment, adding that amount definitely to his total fund of capital, we should ordinarily say that his income for the year included that $1,000, in addition to the amount actually spent for purposes of consumption. Others would say that this $1,000 is not a part of this year's income, but that it becomes a source of income in future years, that, in short, he had deferred his income from this year until future years. The present writer does not approve of this usage, preferring to call the $1,000 a part of this year's income.

Before attempting a final definition of a man's income, it is necessary to distinguish between his money income and his real income. His money income is the amount of money which he can spend in a given period of time, without increasing or decreasing his wealth, that is, leaving him at the end of the period with the same quantity of wealth as at the beginning. His real income is the quantity of desirable objects which his money income will enable him to purchase. In a time of rising prices, he will find that his real income is falling even though his money income remains the same, and in a time of falling prices he will find that his real income is rising if his money income remains the same. His real income, therefore, is the quantity of goods which he may consume in a given period of time without increasing or decreasing his fund of wealth, whereas his money income is the amount of money which he may spend under the same conditions.

It is a common mistake to attempt to define the national income as well as the individual's income in terms of money. In a time of rising prices it may appear as though the national income is enormously increasing. Stated in terms of money, our national income was greater in 1917 than in any previous year. Yet fewer consumable goods were produced in proportion to the population than for many years. Our wheat crop was short of the pre-war average by at least 150,000,000 bushels, yet its total value as stated in terms of money was the greatest in our history. The same may be said of a large number of our most important products outside the list of war materials. In terms of consumable articles, or of articles which contribute anything to our national well-being in normal times, our national income is very small. In terms of money values it appears to be very large, but this appearance is altogether deceptive. Needless to say, the well-being of society is not measured by the number of pieces of money which are handed about in the process of exchange. It is measured in terms of products. In short, our national income is that part of our national production which is left after we have replaced all deterioration or depletion of our national equipment. It is this which determines how well we may live without depleting our national wealth.

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INCOME TAX. Definition.—An income tax is a tax, the amount of which is determined with reference to the income of the taxpayer.

The Income Tax as a Theory of Taxation.—The underlying theory of taxation has undergone many changes. But to-day the commonly accepted principle of taxation is that of faculty or ability — the principle that each individual should be held to help the state in proportion to his ability to help himself. No one form of taxation entirely meets this theoretical test, but under modern conditions income is the best test and, in most cases, measures the ability of the individual better than most other forms of taxation. Quite properly, however, no modern tax system relies entirely upon an income tax. The income tax is therefore a method of taxation which should form an important part in any system of taxation, but which should not be the sole method of taxation.

Many perplexing questions arise in the practical application of the income tax. What is income? Is it gross or net income? Are gifts, inheritances and speculative revenues included? Is money income only referred to, or, also, the equivalent of money income? Is income derived from labor or services to be put on a par with income received from invested capital, inheritances or speculations? Is the small income to be taxed in the same proportion as the large? Is the man of no family to be taxed in the same proportion as one having dependents? These questions not only bring out many of the perplexing questions which arise in connection with the income tax but also emphasize the necessity of incorporating in a well-rounded system of taxation other tests of ability to pay, such as property, product, expenditure and even polls.

In addition to these more or less abstract questions as to the fairness of the income tax, we must consider the practical question of assessment. The income, as a matter of fact, is notoriously the most difficult of all taxes to assess with scrupulous justice and accuracy.

If rightly drawn and efficiently administered the income tax is undoubtedly an indispensable part of any progressive system of taxation.

History of the Income Tax.— The income tax is not entirely a modern invention, although the part which it played in general taxation before the last century was an insignificant one. The Italian cities of the Middle Ages, particularly Florence, developed an income tax. There are some traces of the income tax in England during the 17th century. In France, however, the income tax was considerably developed before the 19th century. The *dixieme* or 10th, enacted in 1710 by Louis XIV, was a real income tax, which finally failed and disappeared because of administrative defects. The development of the income tax in Florence in the 15th century and in France in the 18th century was in each case the result of an advanced economic development and in each case failed because of deplorably inefficient administrative methods.

(1) *England.*— Although the principle of taxing persons according to the size of their incomes had existed in one form or another in England for many centuries, the first English income tax in the modern sense of the term was originated by William Pitt in 1799. It divided incomes into four main schedules and made allowances for children and life insurance premiums. This law was repealed in 1802.

In 1803 an income tax strikingly like the one now in existence was imposed, known as Addington's Property and Income Tax. It provided for particular returns from particular sources and imposed a flat rate of one shilling on the pound, thus omitting entirely the progressive principle. This law, primarily a war tax, was repealed in 1815.

In 1842 Sir Robert Peel revised the tax and although continued for temporary periods and although there was much talk of abolishing it, Gladstone really established it as a part of the fiscal system of England in 1853. It has remained in operation, with certain modifications, up to the present.

The classes of taxable income in the English income tax are as follows: (a) Income arising from the ownership of lands and houses; (b) income arising from the use or occupation of land; (c) income from interest, annuities or dividends; (d) income from any profession, trade, employment or vocation; (e) income from public office or employment.

The tax is levied at the rate of 5 per cent on incomes exceeding £160 ($800). Certain abatements are granted, however, so that the tax is graduated in amount up to that on an income exceeding £700. On incomes less than £800 an abatement of £10 for each child is also given.

In the budget of 1909, David Lloyd George introduced the new principle into the income tax, that of a super-tax. This was fixed at 2½ per cent on those portions of incomes over £5,000 which exceed £3,000. There was also introduced the principle of differentiation, which covers that rate of tax on earned incomes as compared with unearned incomes.

The English income tax has been a success and is now an integral part of the tax system of the country. In the fiscal year 1913–14, it raised £47,249,000 or 23.8 per cent of the total revenue of the United Kingdom. Since the outbreak of the war the income tax has become an even more important source of revenue. On 5 Dec. 1914, the rates were doubled. The revenue derived from the income tax for 1915–16 amounted to over £128,000,000, or more than 38 per cent of the total revenue. The Budget for 1916–17 estimates the amount to be derived from the income tax at £195,000,000.

In the budget for 1916–17 the rates of the income tax were still further raised and the scale now stands as follows:

	Per cent
Rates for earned income:	
Not exceeding £500	11¼
Exceeding £500, but not exceeding £1,000	12½
Exceeding £1,000, but not exceeding £1,500	15
Exceeding £1,500, but not exceeding £2,000	18¾
Exceeding £2,000	25
Rates for unearned income:	
Not exceeding £500	15
Exceeding £500, but not exceeding £1,000	17½
Exceeding £1,000, but not exceeding £1,500	20
Exceeding £1,500, but not exceeding £2,000	22½
Exceeding £2,000	25
Exemptions and abatements:	
Not exceeding £130	Exemption
Exceeding £130, but not exceeding £430.	Abatement of £120.
Exceeding £430, but not exceeding £600.	Abatement of £100.
Exceeding £600, but not exceeding £700.	Abatement of £70.

Several special war concessions have been made to compensate for reduction of income due to the war. For example, instead of averaging income for the three years *preceding* the year of assessment, the latter may be included as one of the three. Again, anyone whose income is less by 10 per cent than that for which he is assessed is entitled to a refund. Special reductions have also been made to persons serving in the army or navy, the Red Cross Society or other similar organizations. Persons whose income does not exceed £700 obtain an abatement of £25 for every child under 16 years of age.

Life insurance premiums, up to an amount not exceeding one-sixth of the total income, may, with certain limitations, be deducted from income before assessment.

Other changes in the income tax have tended to smooth out the rough places and make it more easily workable and flexible.

The reasons for the success of the English income tax may be summed up as follows: (a) Blending of regard for local interests and fiscal productiveness; (b) ingenious system of administration; (c) absence of inquisitorial procedure; (d) system of stoppage at the source; (e) moderations of rate; (f) principle of differentiation; (g) principle of progression.

(2) *New Zealand.*—New Zealand was the first of the British colonies to adopt a comprehensive income tax. It was first adopted in 1891. The tax applies only to incomes above £300. The rate on the amount of income between £300 and £1,300 is 2½ per cent, and over £1,300 is 5 per cent. In 1913–14 the income tax yielded £554,271, or 4.5 per cent of the total revenues of the colony (but 9.4 per cent of the revenue raised by taxation). The total cost of assessment and administration was only 1.31 per cent. The total yield of the tax in New Zealand is small because incomes derived directly from land are exempt from the income tax, land being the subject of a special tax assessed on capital value. Since the war began the rate of the tax has been increased by one-third.

(3) *Australia.*— Each of the six Australian colonies has an income tax. That in New South Wales was introduced in 1895; Queensland in 1902; South Australia in 1884; Tasmania in 1902; Victoria in 1895; Western Australia in 1907.

The laws in the various colonies are generally similar. The chief difference is that some distinguish sharply between earned and unearned incomes, or as it is sometimes put, income from property and income from personal exertion. In some of the colonies the income tax is closely connected with and complicated by the land tax. The amount of exemption varies from £100 to £200. The rate of taxation varies from 1 to 5 per cent. The maximum is usually 5 per cent, which is levied only on the highest incomes. In each of the colonies the income tax is fiscally important and in South Australia brings in as much as 55 per cent of the total revenues.

(4) *Germany.*—The German Empire, as such, does not levy any income tax. Each of the 26 German states has a complete or partial income tax. The systems are extremely varied, but all partake to a considerable extent of the prevailing militaristic organization.

Prussia is not only the most important, but in some respects most progressive, and needs special comment, because the income tax there has many excellent features. The Prussian income tax was first provided for in the law of 1891. Incomes of less than 900 marks are exempt. Certain other exemptions are granted, such as military pay, sinking funds and some other special forms of income.

The tax is very finely graduated, beginning at the lowest class at only .57 per cent. From this rate it increases by very small increments to 3.15 per cent in the class 9,500—10,500 marks. For higher incomes the rate is approximately 4 per cent. For companies with limited liability the rate is very slightly higher. Persons having a taxable income of not more than 3,000 marks may deduct 50 marks for each dependent.

The method of administration is inquisitorial in the extreme and a variety of checks are provided. Each person is required to make out a declaration, but the amount of income taxable is decided by one tribunal for those having incomes of less than 3,000 marks and another for those of greater incomes.

In some municipalities local taxes are assessed on the basis of the royal tax returns, in some cases the taxes amount to 100 to 200 per cent of the government income tax. The government, in order to meet certain deficiencies, has added a super-tax, varying from 5 to 50 per cent in various income clauses, and for persons and corporations.

The average annual yield of the Prussian income tax during the five years ending 31 March 1912, was 298,120,000 marks or 70.8 per cent of the income of Prussia from taxation. Later figures, owing to the war, are not available.

(5) *Other Countries.*— Practically every important industrial and commercial country of the world has developed an income tax. If space permitted, it would be especially worth while to review the legislation of France, Italy and Switzerland. In practically every country where it has been tried the income tax has become a permanent and important part of the fiscal system.

In South America, however, the principle of the income tax has not been popular and the only country that has had an income tax for several years is Brazil. In Bolivia, there is a tax on dividends of certain corporations, but nothing in the nature of a comprehensive income tax law. In Uruguay there is a tax on revenue derived from certain rents. In one or two other countries the income tax has been proposed, but has not met with much favor.

The Income Tax in the United States.— Some difference of opinion exists among authorities on taxation as to whether certain early colonial taxes in this country were really income taxes in the modern sense of the term. In the 17th century the system of taxation in Massachusetts colony contained certain elements resembling an income tax. Certain of these principles have continued in operation there even down to the present.

Similarly in the colonies of Connecticut, Rhode Island, New Hampshire, Vermont, Virginia and South Carolina, there are to be found many expressions in their tax laws indicating that "faculty" or "ability" in income, was to be the chief measure in determining the amount of tax to be paid.

Since the formation of the Union, income taxes have been in force for varying periods in at least 20 States. This form of taxation has been tried in almost every known form. Wherever tried the State income tax has always been an almost unqualified failure. There has been just one exception to this general experience and that is in Wisconsin, where conditions are in many respects entirely abnormal. A study of the history of the income tax in our States leads to the conclusion that the failure of the tax has been due to the administration of the laws. This in turn may be attributed to four causes: (1) The method of self-assessment; (2) the indifference of State officials; (3) the persistent effort of taxpayers to evade the tax; and (4) the nature of the income. State lines mean little in this country and usually income, both personal and corporate bears very little relation to State boundaries. Experience seems to teach, therefore, that the income tax cannot effectually be applied in this country on a Statehood basis.

(1) *The Civil War Income Tax.*—The first and practically the only experience of the Federal government with income taxation was primarily as a war tax during the period of 1861-72. The law as first passed provided for a tax of 3 per cent on incomes from $600 to $10,000; of 5 per cent on those from $10,000 to $50,000 and of 7½ per cent on those over $50,000. By later amendment these rates were changed, and the exemption was raised in 1867 to $1,000. The provision for the income tax, which was merely a part of the general revenue act, was not reenacted in 1872 and ceased to exist as a revenue measure. Although little administrative machinery was provided and despite the fact that the law was clumsily and unskillfully drawn, it may be said to have been fairly successful. During the years 1863 to 1873 a total of $376,150,204 was raised, amounting to about 20 per cent of all internal revenue. In 1865, 28.3 per cent of the revenue was raised in this way. Even so, the tax probably brought out only a small proportion of the total taxable income.

(2) *The Federal Income Tax of* 1894.—The second income-tax provision in this country became a law on 28 Aug. 1894. It provided a tax of 2 per cent upon all incomes exceeding $4,000. There were many defects and incongruities in the act. For example (1) income of less than $4,000 from corporate dividends was taxed, income from other sources not taxed; (2) personal property by gift or inheritance was taxed, inheritance of real estate was not taxed; (3) inheritance of personal property was taxed 2 per. cent; (4) farmers were not taxed upon produce retained and consumed by them; (5) no provision was made for collection at the source; (6) no allowance was made for size of families.

Immediately the constitutionality of the tax was called into question in the case of Pollock vs. Farmers' Loan and Trust Company (157 U. S. 429; rehearing 158 U. S. 601). The constitutional provision involved was the following:

«Representative and direct taxes shall be apportioned among the several States, which may be included with this Union according to their respective numbers, which shall be determined by adding to the whole number of those bound to service for a term of years and excluding Indians not taxed, three-fifths of all other persons.»[*]

«No capitation or other direct tax shall be laid unless in proportion to the census hereinbefore directed to be taken.»

The court decided after a rehearing, by a majority of one, that the income tax as a whole was unconstitutional. The essential reasons as stated by the court were as follows:

«First. We adhere to the opinion already announced that taxes on real estate being undisputably direct taxes, taxes on rents or income of real estate are equally direct taxes. Second. We are of opinion that taxes on personal property, or on the income of personal property, are likewise direct taxes. Third. The tax imposed by sections twenty-seven to thirty-seven, inclusive, of the act of 1894, so far as it falls on the income of real estate and of personal property, being a direct tax within the meaning of the Constitution, and, therefore, unconstitutional and void because not apportioned according to representation, all those sections, constituting one entire scheme of taxation, are necessarily invalid.»

(3) *The Sixteenth Amendment.*—In a special message to Congress on 16 June 1909, President Taft recommended that Congress propose «an amendment to the Constitution, conferring the power to levy an income tax upon the national government without an apportionment among the States.» The amendment as finally agreed upon by Congress for submission to the several States was as follows:

«Congress shall have the power to lay and collect taxes on income from whatever source derived, without apportionment among the several States, and without regard to any census or enumeration.»

This amendment was ratified by 42 States and the seemingly impossible, an amendment to the constitution, had been accomplished. The amendment became a part of the constitution on 25 Feb. 1913.

(4) *The Income Tax of* 1913.—The income tax now in operation in this country became a law on 3 Oct. 1913. It marks a new era in the history of American finance. It aims to redress the inequality of taxation which was a predominant feature of the American fiscal system.

(a) Who is liable to the Income Tax? The law applies to every American citizen, including those resident abroad. It applies to every person residing in this country. It applies to non-residents having incomes obtained from this country.

The law applies to every corporation, joint-stock company or business association (with a few exceptions) in the United States. Double taxation is avoided by permitting individuals to make deduction for income on which the tax has already been paid.

(b) What is taxable income? The law of 1913 states that net income «Shall include gains, profits and incomes derived from salaries, wages, or compensation for personal services of whatever kind, and in whatever form paid; or from professions, vocations, businesses, trade, commerce, or sales or dealings in property, whether real or personal, growing out of the ownership or use of or interest in real or personal property; also from interest, rents, dividends, securities, or the transaction of any lawful business carried on for gain or profit, or gains or profits and income derived from any source whatever, including the income from, but not the value of, property acquired by gift, bequest, devise, or descent."

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[*] Important decisions preceding the one in question on this point were: Hylton vs. U. S.—3 Dallas 171 (1796); Pacific Insurance Co. vs. Soule—7 Wallace 435 (1868); Veazie Bank vs. Fenno, 8 Wallace 533 (1889); Scholey vs. Rew—23 Wallace 331 (1874); Springer vs. U. S.—102 U. S. 586 (1880).

The term income in this connection is confined to actual money income. The general view is that income is regular and periodic and that irregular returns in the shape of inheritances should be reached by the inheritance tax. Profits from transactions in stocks and real estate are included only when realized. A clear distinction seems to be made between gross and net income.

(c) *The Tax Rates.*— The tax applies to individual incomes only when they exceed $3,000; $4,000 in case of married persons. There is no minimum exemption in case of corporations. The tax is a graduated one, and the rates are progressive. A tax of 1 per cent is imposed on all incomes exceeding the minimum, and an "additional" tax is imposed on higher incomes in accordance with the attached schedule.

PERCENT	On amounts exceeding	And not over
1	$20,000	$50,000
2	50,000	75,000
3	75,000	100,000
4	100,000	250,000
5	250,000	500,000
6	500,000	....

(d) *Stoppage at Source.*— In respect to collection this law is unlike any preceding law in this country. It provides that all payers of income, whoever they may be, shall deduct the annual legal tax. There are three exceptions only: (a) dividends on stocks of corporations; (b) interest on bonds; (c) payments to a corporation.

(e) *Certain Administrative Features.*— It is specifically provided that no income return shall be divulged. Every person having an income in excess of $3,000 must file on or before 1 March under oath a complete return of his income. Corporations are required to file this statement at regular periods. Delay or fraud are heavily penalized in the case both of individuals and corporations.

(5) *Amendments of* 1916.— In the revenue act of 1916, an entirely new income tax law takes the place of the one enacted on 3 Oct. 1913. Essentially the law is the same, but there are some modifications which are of considerable importance. The most significant changes are a doubling of the "normal" rate and increases in the "additional" rates, especially those falling upon the very large incomes. The normal rate has been raised from 1 to 2 per cent. The following table compares the old and the new rates:

PART OF INCOME TO WHICH APPLICABLE.

Old law	New law	Tax, Per cent
$20,000 to $50,000	$20,000 to $40,000	1
50,000 to 75,000	40,000 to 60,000	2
75,000 to 100,000	60,000 to 80,000	3
100,000 to 250,000	80,000 to 100,000	4
250,000 to 500,000	100,000 to 150,000	5
500,000 to any excess	150,000 to 200,000	6
	200,000 to 250,000	7
	250,000 to 300,000	8
	300,000 to 500,000	9
	500,000 to 1,000,000	10
	1,000,000 to 1,500,000	11
	1,500,000 to 2,000,000	12
	2,000,000 to any excess	13

A serious attempt was made in Congress to lower the $3,000 exemption, but this was finally retained as in the original act. Under the old law it was held that profit, however made, must be included; the new law allows for losses in incidental transactions, not exceeding profits of a similar kind. Non-resident aliens are now required to pay the tax so far as it concerns interest on bonds with underlying assets situated in the United States.

The new law, then, aside from the increase in rates, makes no great changes in substance. Practically all of the changes that are made are for the better and represent a natural development following administrative experience. The changes in form are much more noticeable and extensive. The arrangement of the old law was unfortunately haphazard and unsystematic; references were unnecessarily difficult, various terms and phrases were ambiguous, and there was a looseness in the use of even technical terms that was very confusing. The recast law is a great improvement in regard to these matters.

(6) *Critique of the Law.*—The theory of the income tax as a part of our fiscal system may be accepted without further question. The application of that principle of taxation in the present law has, however, been seriously criticised. Without argument, the main points of criticism may be briefly summarized as follows: (a) The exemption of incomes below $3,000, and for families below $4,000, is undoubtedly high. If the exemption were lowered, many additional persons would be added to those taxed, but it is doubtful if the amount received would be commensurate with the task of collection. (b) The stoppage-at-the-source provision throws much of the burden of collecting the government's revenues upon banks, trust companies, corporations and other agents. To meet this difficulty it was suggested that information-at-the-source be substituted for stoppage at the source. The law, however, remains unchanged in this respect. (c) Certain discrimination against incomes received in the form of corporate dividends. The phraseology of the law also requires double and even multiple taxing of holding companies. (d) There is double taxation of both resident aliens and non-resident citizens. (e) The principle of differentiation between funded and earned incomes, common in most other countries, is not introduced. (f) The monetary conception of income is almost exclusive and no account is taken of income in the shape of farm produce or house rent, consumed by the producer or owner.

(7) *Practical Results of the Income Tax.*— The success of any tax may be measured by the net amount of revenue collected, by the equality of assessment, and by the friction between the tax collecting authority and the tax payers. The federal income tax is as yet too new to warrant a final judgment. The amount of revenue collected has been considerable. The cost of collection has, however, been large. The friction between the tax collecting authority and the taxpayer has undoubtedly been greater than is warranted. It will undoubtedly decrease as the collectors gain experience and ability in levying the tax.

During the fiscal year 1915–16, 366,443 corporations reported. Of these, 190,911 showed an aggregate income of $5,184,492; 389 upon which there was assessed income tax in the aggregate sum of $51,844,423.89; 175,523 returns showed an operating deficit, or no taxable income. During the fiscal year 1915–16, there was actually collected $56,972,720.88.

The following comparison shows the increased efficiency of the tax and the administration of it during the past two years:

	1915	1916
Returns received.......	299,445	366,443
Taxable returns........	174,205	190,911
Total taxes assessed....	$38,986,952.18	$58,549,081.91
Per cent increase.......	....	66.5

The results of the personal income tax were larger than those from the corporate income tax, and are extremely interesting in their range and distribution. Income tax collections from individuals amounted to $67,943,594.63 for the fiscal year 1915–16, as against $41,046,162.09, in the fiscal year 1914–15, and $28,253,534.85 for the fiscal year 1913–14.

The following table gives the amount of normal and additional tax collected in the last two years, 1915 and 1916:

	1915	1916	Increase
Income tax, normal....................	$16,559,492 93	$23,995,777 28	$7,436,284 35
Income tax, additional:			
Net incomes—			
$20,000 to $50,000....................	4,106,673 36	6,091,775 71	1,985,102 35
$50,000 to $75,000....................	2,500,890 33	4,071,361 94	1,570,471 61
$75,000 to $100,000....................	2,102,927 01	3,623,472 62	1,520,545 61
$100,000 to $250,000....................	5,949,104 55	10,936,326 15	4,991,221 60
$250,000 to $500,000....................	3,328,423 78	6,393,858 64	3,065,434 86
Exceeding $500,000....................	6,439,004 54	12,647,862 91	6,208,858 37
Accepted offers in compromise, etc....................	63,645 59	183,159 38	119,513 79
Total....................	$41,046,162 09	$67,943,594 63	$26,897,432 54

Perhaps as interesting to the general student of economics and sociology, as to the expert in taxation, is the range of incomes from which the tax was collected. The following table gives the number of persons in each income group:

Income group	Number
$3,000 to $4,000....................	69,045
4,000 to 5,000....................	58,949
5,000 to 10,000....................	120,402
10,000 to 15,000....................	34,102
15,000 to 20,000....................	16,475
20,000 to 25,000....................	9,707
25,000 to 30,000....................	6,196
30,000 to 40,000....................	7,005
40,000 to 50,000....................	4,100
50,000 to 75,000....................	4,791
75,000 to 100,000....................	2,056
100,000 to 150,000....................	1,793
150,000 to 200,000....................	724
200,000 to 250,000....................	386
250,000 to 300,000....................	216
300,000 to 400,000....................	254
400,000 to 500,000....................	122
500,000 to 1,000,000....................	209
1,000,000 and over....................	120
Married....................	266,153
Single { Men....................	47,583
Single { Women....................	22,916
Married women rendering separate return......	4,819
Total....................	336,652

The function of collecting the federal income tax is lodged in the office of the Commissioner of Internal Revenue. This office also collects revenues on liquors, tobacco, documents, proprietary medicines, playing cards, etc. It is, therefore, impossible to say exactly what is the cost of collecting the income tax. Allowing a reasonable overhead the collection of the income tax probably costs not less than $1,950,000 or 1.56 per cent of the amount taxed.

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INCONNU, ĭn-kō-nū′, Fr. ăn-kō-nü′, the French-Canadian name of a fish of the rivers that enter the Arctic Ocean (*Stenodus mackenzii*), intermediate between a salmon and a whitefish in its characteristics, and of great value as food for the people of that region. Specimens often weigh 10 to 15 pounds.

INCORPORATION, (1) the act of forming a legal corporation, or the body so formed. In England, incorporation is generally under the control of Parliament, corporations being created usually under general statutes but sometimes under special acts. They may be created also by royal charter. In the United States they are created by Congress or the legislatures of the various States, usually under general statutes. The process of incorporation is simple, consisting of filing a certificate of incorporation with the proper officer, giving the names of the incorporators, directors, etc. By incorporation and compliance with other legal formalities, the association acquires rights similar to those possessed by a natural person. It can usually acquire and convey property, sue and be sued, make contracts, elect or remove officers or members, etc. It becomes a complete legal entity, distinct from the incorporators or its members. The courts in the United States generally have power to determine whether any given petition for incorporation has met all legal requirements. The certificate of incorporation constitutes the charter of a corporation formed under general statutes, whereas in the case of a corporation formed by royal grant or special act, the grant or statute creating it constitutes the charter of the corporation.

(2) The act of uniting, as papers, by reference in a will. Such papers in the case of a will are treated as part of it. See Corporations, Legal

INCREMENT, The Unearned. See Single Tax.

INCUBATOR, a machine employed for the artificial hatching of chickens from eggs. Such devices were known to mankind from early ages. Pliny says that the Egyptians thus hatched 100,000,000 chickens a year. While artificial incubation was introduced into France and England during the 18th century, the incubator was brought to greatest perfection in the United States in the 19th century. The first patented invention of the modern incubator was in 1847, but any practical success in such machines cannot be met with before 1877, when Rouillier and Arnoult exhibited their hydro-incubators at the Paris Exhibition.

There are two general classes of incubators, those in which hot air is used for the maintenance of heat ~~and the~~ application of it to the eggs, the other in which hot water serves this purpose. An automatic incubator of first-class make it equally efficient whichever of these two heating mediums is employed, but there are many different types of machine offered for sale, and the struggle between cheapness and efficiency sometimes leads to the sacrifice of the latter. There are certain essentials to an incubator which must be attained at any cost, and the machine that is deficient in any one of these is a failure, which means that it cannot guarantee to yield of living chicks at least 80 per cent. The following may be enumerated as absolute requisites in a good incubator: (1) An egg chamber heated at a uniform temperature. It is best that the heat should come from above, when it is likely to be reverberated from the floor of the chamber and to more evenly affect the eggs, and may at once strike the germinal vesicle which from its lightness always rises to the upper surface of the yolk. (2) A source of heat which is self-regulative. The thermo-regulator in general use is actuated by an arm thrust within the egg chamber, and must be sensitive to an atmosphere of ½° or at most 1° above that which is desired. (3) Good ventilation within the egg chamber, with some provision by which a certain degree of moisture may be maintained in the air. (4) Added to this, is a good turning apparatus. There are very many devices for effecting this purpose; perhaps the best is that of a tray fitting exactly over the tray in which the eggs are laid, and by the turning of which the eggs may be replaced in a reversed position in the applied tray.

Of course the aim of a true incubator is to reproduce as accurately as possible by artificial means the conditions of natural hatching under a setting hen. Thus the supply of heat and air must be conformable to a fixed standard. The temperature is to be kept unchanged at 100° F., or a little above that, by placing the incubator in a room not exposed to draughts. To make accident in this respect impossible, a cellar, or specially built chamber, should be used, where no access of colder air may cause a fall in temperature, and a sensitive thermo-regulator furnish automatic means of preventing excessive heat from destroying the vitality of the eggs. Moisture must be preserved in the air of the egg chamber that the eggs may not be shriveled by excessive evaporation. There must also be adequate ventilation, that no harmful gases sicken or kill the hatching chick. The turning of the eggs is considered necessary, because the sitting fowl has the habit of so doing, but the eggs should not be disturbed after the 18th day, nor the incubator be opened after that date, until the hatch is completed. With regard to the moisture of the air, it has been considered proper after studying the progress of evaporation, as reckoned from the loss of weight in a fertile egg during the process of hatching, that a humidity of 45 per cent is the safest degree of saturation.

Various ways have been resorted to of taking care of the chickens after they leave the incubator. They must at first be kept in an atmosphere of from 90° to 100°, at least for the first week, and heated places of shelter, known as brooders, must be prepared for them. There are many patterns and kinds of brooders, which are manufactured by the same firms as those which make incubators. The requisites for brooders are: (1) The temperature of the first week, as given above should be gradually lowered. (2) The greatest diligence should be applied to secure and maintain cleanliness, dryness and good ventilation. (3) Their construction should be such that newly-hatched chickens may always be in view. As the chicks grow toward fledging, facilities should be afforded them to leave the brooder for exercise. See also POULTRY. Consult Cooke, P., 'Successful Incubation' (Los Angeles 1911); 'Incubators and Chicken Rearers' (New York 1912); Hawks, G. B., 'Incubation and Brooding' (Clinton, Wis., 1909); Hurst, J. W., 'Successful Incubation and Brooding' (London 1911); Robinson, J H., 'Principles and Practice of Poultry Culture' (Boston 1912).

INCUBUS (Lat. "one who lies upon"), a spirit to whom was ascribed the oppression known by the common name of nightmare, in Greek *ephialtes* (from *epi*, and *hallomai*, I leap upon). These demons play an important part in the superstitions of the Middle Ages, having been perhaps not infrequently employed, like the older gods of Greece, to cloak the advances of earthly lovers. See NIGHTMARE.

INCUMBRANCE, in general, any charge or burden upon real property held by any one other than the real owner. It thus includes judgments, leases, mortgages, mechanics' liens and even restrictive agreements. In a conveyance of real property the seller usually agrees to a covenant against incumbrances under the terms of which he secures the buyer from any loss arising through any incumbrance upon the property at the time of the sale.

INCUNABULA, is a term applied by bibliographers to editions of books printed during the early period of the art, and is generally limited to works which appeared previous to 1500. The incunabula are divided into xylographic and typographic, the former those printed from engraved blocks, the latter from movable types. Among the most highly esteemed of the incunabula are those which are first editions of the ancient classics. See BIBLIOGRAPHY.

INDAJA PALM. See ATTALEA.

INDEMNITY CONTRACT, a form of contract which, while not of recent origin, is becoming much more common than formerly. Such a contract is any form of written agreement between two parties whereby one party agrees to indemnify or save harmless the other party for loss or damage arising out of a particular transaction, or against some specified claim of a third party. It is an original contract and must be in writing in order to come within the statute of frauds. Such contracts are frequently made in the form of a mortgage. But the substance and not the form is important, and the courts have usually given them a liberal construction with the intent of furnishing the party to be indemnified with all of the protection that was manifested in the minds of the contracting parties when the contract was signed. Indemnity contracts are not adverse to public policy; but they are not binding when they undertake to protect persons against the consequences of illegal acts. Like other contracts, they must be founded on a sufficient consideration, and furnish indemnity only to the party named as indemnitee, and do not extend to a person having only a contingent or collateral interest in the subject matter of the contract.

INDENTURE, *in law*, a form of deed between two or more persons, usually executed in duplicate on one piece of paper or other similar material, and the parts separated by a notched or toothed cut. Indenting is seldom practised to-day, but the instrument retains the name. The term should be carefully distinguished from a deed poll, which is now identical in form. An indenture is required only where the grantee or obligee assumes an independent obligation from the grantor or obligor, whereas a deed poll is required where an obligation is assumed by one party only or by a number of persons in the same obligation.

INDEPENDENCE, Iowa, city and county-seat of Buchanan County, on the Wapsipinicon River, 70 miles southwest of Dubuque, and on the Rock Island and the Illinois Central railroads. It is the centre of an extensive horse-breeding, farming and dairying region. There is located here the well-known Rush Park, with its kite-shaped race track, the State insane asylum for northern Iowa, public library and other buildings. Culverts and gas engines are manufactured and the electric-light plant and waterworks are owned by the municipality. Pop. 3,683.

INDEPENDENCE, Kan., city and county-seat of Montgomery County, located on the Verdigris and Elk rivers, 85 miles south of Kansas City, on the Atchison, Topeka & Santa Fé and Missouri Pacific railroads. The city has interurban connections with all the principal cities and towns in this section. It is the centre and distributing point for a large and rich agricultural district, has a number of large manufacturing plants, is the home of the Kansas Natural Gas Company, headquarters for the Mid-continent Oil and Gas Company, home of the Prairie Oil and Gas Company, whose building is the largest in the State. There is abundance of natural gas and oil in the surrounding territory. Some of the largest plants are cement mills, planing mill and revolving-door plant, sash and door plant, glass plant, oil refinery, rubber plant, iron foundries, alfalfa mills and creameries. There are also a number of important smaller concerns. The city has a public library, federal building, municipal building, court house, and the finest and best hotel in the State Pop. 13,386.

INDEPENDENCE, Mo., city and county-seat of Jackson County, five miles from Kansas City, on the Kansas City & Indianapolis, Missouri Pacific, and the Chicago and Alton railroads. The city is considered a residential suburb of Kansas City. The town was settled in 1827, and in 1838 the Mormons' rendezvous was located here, and from hence the Latter-day Saints pursued their journey to Utah. It was the scene of exciting events during the Civil War, the capture of the Federal garrison in 1862, and a Confederate defeat in 1864. Stock-breeding, fruit-growing and canning are the chief industries along with numerous domestic manufacturers. Under the charter of 1889 the city is governed by a mayor and city council elected every two years. The electric-light plant is owned by the municipality. Pop. 9,859.

INDEPENDENCE, Ore., city of Polk County, 12 miles southwest of Salem, on the Willamette River, and on the Independence and Monmouth, and the Southern Pacific railroads. Great quantities of hops are grown in the district and form an important article of trade. There is also a good trade in cereals and other agricultural products. Its industrial establishments comprise a creamery, foundry and machine shops, saw mills and flour mills. Pop. 1,160.

INDEPENDENCE, Declaration of. See Declaration of Independence.

INDEPENDENCE HALL, Philadelphia, a low plain brick building on Chestnut Street; begun in 1732, but not completed until 1747, as a state-house for the colony of Pennsylvania, as closely connected with great national events as Faneuil Hall or the Old South in Boston. It was occupied as a state-house while unfinished, in 1736; the tower was added in 1750. After its completion it was used by the assembly, the supreme court, and the governor's council of the province of Pennsylvania. Here the Continental Congress held its sessions; here Washington was appointed commander-in-chief of the Continental armies, on John Adams' motion; here the Declaration of Independence was adopted and was read from its steps to the assembled crowds in front. The Convention of 1787, which framed the Constitution, was also held here. It is now maintained as a museum of historical relics, especially of the Revolution. In the tower is still kept the famous «Liberty Bell» (q.v.). In recent years it has been carefully restored to its original appearance. Consult Belisle, D. W., 'History of Independence Hall' (Philadelphia 1859); Etting, F. M., 'An Historical Account of the Old State House, etc.' (2d ed., Philadelphia 1891).

INDEPENDENCIA, ĕn-dā-pān-dān'sya, on **FRAY BENTOS,** frī bān'tōs, Uruguay, capital of the Department of Rio Negro on the Uruguay River. The chief industries are stock-raising, meat-packing and the manufacture of meat products. The city is well laid out and there are several fine modern buildings, including government edifices, the hospital and schools. The river is navigable to ocean steamers, thus increasing the importance of the town as a business centre. Pop. about 10,000.

INDEPENDENT CATHOLIC CHURCH OF THE UNITED STATES, or OLD CATHOLICS, a Polish religious body organized in Chicago, among disaffected Roman Catholics. Its founder, Rev. Anthony Kozlowski, attended one of the conferences of the Old Catholic Church in Europe and was there consecrated a bishop. The church has acquired considerable property in Chicago and has established a hospital, dispensary, orphanage, home for the aged, primary, grammar, high and industrial schools. The society had in 1915 over 18,500 members, and 35 ministers and 41 churches.

INDEPENDENT METHODIST CHURCH. See Methodist Churches of the World.

INDEPENDENT MOVEMENTS IN POLITICS. See Vote, Voters, Voting.

INDEPENDENT ORDER OF ODD FELLOWS. See Odd Fellow.

INDEPENDENT VOTE. See Vote, Voters, Voting.

INDEPENDENTS. See Congregationalism.

INDETERMINATE SENTENCE. A sentence to imprisonment without a fixed time for its termination. It is in accordance with the new principle of penology that the object of imprisonment is primarily the reformation of the offender and consequently that he is to be released as soon as he has reformed and shown his fitness to again become a member of society. In practice, the indeterminate sentence has minimum and maximum limits. Thus a prisoner may be sentenced for not less than four nor more than seven years. The indeterminate sentence was first applied in New York to boys and was not extended to adults until 1876, when the Elmira Reformatory was established. Massachusetts and Ohio soon followed the example of New York and at present about half the States of the Union have adopted the indeterminate sentence in their penal codes. European countries have not taken to the plan, mainly because of their century-old concepts of crime, punishment and vindictiveness which more properly belong to less enlightened age. See Parole System; Prisoners, Probation of.

INDEX, a series of references arranged in alphabetical order usually placed at the end of a book. The need of indexing has become more and more apparent as the mass of material published has increased and the spread of education has increased by tens of thousands the numbers of people who wish to make use of this material. It was at one time seriously proposed, both in England and America to deprive an author who published a book without an index, of the privilege of copyright. In general there are two classes of books to be indexed — viz. books of facts and books of opinion. In indexing the former experience, care and common sense must be exercised, and the work must be systematic and not casual. In the latter class the same qualifications are required and something else — viz. the insight of the precis writer. The index maker must have a fair knowledge of the subject in hand and must also take into account the viewpoint of the reader and the needs of the latter. An index must be exhaustive in its indication of the various points of the book, and concise in expression, and in addition, the indexer must be careful in the choice of his headings or leaders. The same subjects must be collected under one heading and must not be separated under synonyms. An author frequently uses periphrases to escape from the repetition of the same fact in the same form; but these periphrases will give little information if inserted as headings in an index, and it is in this power of selecting the best catchword that the good indexer manifests his superiority over the commonplace worker. There are other kinds of indexes; but these require an explanatory adjective, as classified, chronological, etc. In indexing names it is most important to specify the cause of reference, as a block list of references after a name is almost useless. It is also important to bring all the references to one man under one heading, and not to separate them under the different names or titles he may have borne. There should be one index for a complete work and not a separate index for each volume. No classification should be allowed in an alphabetical index as the consulter is only confused and annoyed if he has to look in a succession of alphabets arranged under such headings as original articles, notes, correspondence, etc. The preparation of an index involves three operations: compiling, arrangement, and printing. Each index maker will find out the mode of procedure which is most suitable to himself; a good way, now well nigh universal, is to make each entry on a separate slip, after which the slips are arranged in alphabetical order. Library supply firms supply different types of slips and alphabetical trays, which are an important aid to the indexer. When the slips have been arranged care must be taken to see that there are no repetitions of the same subjects under various synonyms. Words spelled alike, but of different meaning must be repeated as headings. Now is the time to make the cross references, and here considerable judgment is required. When the entries are short and few, it is better to repeat them than to refer from one to the other; but in the case of long entries cross references are very advantageous and it is always well to refer to cognate headings. No reference to the contents of a general heading, which is without subdivision, should be included. If a general heading is divided into sections, and each of them is clearly defined, they should be «cross-referenced,» but not otherwise. Alteration and revision of headings will be found necessary frequently. The value of an index is greatly enhanced by the proper setting out of the entries with judicious use of different types. When a book is a complete treatise on a special subject, a well-made index will form an admirable key to the subject and be in itself intrinsically useful. The above general principles apply to indexes of separate books; but indexes are made to a particular subject in which the references relate to several books. The increase of these indexes is much to be desired as they form admirable helps to knowledge. Consult Clarke, 'Manual of Practical Indexing' (London 1905); Kaiser, 'Systematic Indexing' (New York 1911); Petherbridge, 'Technique of Indexing' (London 1904); Wheeler, 'Indexing: Rules and Examples' (Albany 1905; rev. ed., 1913).

INDEX, Cephalic, Cranial, etc. For some years anthropologists have taken special care in determining geometrically the forms and dimensions of the human cranium among the different races of mankind. The task is a difficult one because the human cranium is not a rectangular box. Various procedures have come into general use to determine the measure of the distances of the head, the skull, the facial cavities, and the brain capacity. Indexes are the terms used to define the relations existing between these linear distances and the following are the principal. The Cephalic index is the relation which exists between the transverse diameter of the head and the anteroposterior diameter. The latter is taken from the middle and lower part of the frontal bone to the furthest part of the occiput. The transverse diameter is the greatest line at right angles to the anteroposterior. In practice it is assumed that the length equals 100, and the width is represented as a percentage of this. The result is the index for which the formula is

$$\frac{\text{greatest width} \times 100}{\text{length}} = \text{cephalic index}$$

This index is an important medium for classifying skulls. A low index indicates a great length as compared with the width, giving an elongated or oval skull. A high index indicates a rounded skull. A common classification of skulls on the basis of this cephalic index is the following:

Subdolicho cephalic	Below 70
Dolicho cephalic	70 to 77.8
Mesoticephalic	77.8 to 80.
Subbrachy cephalic	80 to 83.3
Brachy cephalic	83.3 to 85.
Hyperbrachy cephalic	Above 85

It must be remembered that these divisions are arbitrary and vary slightly for the cephalic index, and even in different countries. As a general result of this classification we find that Eskimos, African negroes, Fuegians, Veddahs, Maoris, Fiji islanders, and certain peoples of northern Europe are dolichocephalic, while American Indians, Malays, Mongols, Lapps, Finns, Poles, Tyroleans are brachycephalic. British, French, Germans, Greeks, Japanese, Chinese are mesoticephalic. The cephalic index alone is insufficient for a proper classification of the skulls or heads of the different races. Recourse is had therefore to other indices which taken in conjunction with the cephalic, will give the shape of the head. The frontal index is the relation between the least frontal diameter and the greatest cranial diameter. By contrasting height with length a vertical index is obtained according to which we get platycephals, or low skulls; metriocephalic, or moderate; and acrocephalic, or high skulls. The facial index is that resulting from a comparison of the length and width of the face The length is measured from the root of the nose to the tip of the chin, the forehead being part of the cranium and therefore excluded; the width is calculated by the projecting convexities of the zygomatic arches. High faces are those above and low faces those below 90. A nasal index is measured from its height and width, the latter calculated from the width of the nasal wings. According to the result a skull or head is leptorhine, or narrow below 48; mesorhine, or medium from 48 to 53; and platyrhine, or broad nosed, above 53. The orbital index is that resulting from the relation of the height and width of the orbit or pyramidal chamber which lodges the eye-ball. The width is calculated from the *dacryon* on the inner wall to the most distant point on the outer edge of the wall. The width being always greater than the height the formula for the orbital index is:

$$\frac{\text{height} \times 100}{\text{width}} = \text{orbital index}$$

According to this index we have megaseme, or great orbits, above 89; mesoseme, from 84 to 89; and microseme, below 84. Other indexes are the pelvic, the sacral, the dental and the pilastric obtained by measurement and computation similar to those described above. Methods differ widely according to the different schools of anthropologists. Consult Broca, ‘Instructions générales pour les recherches anthropologique’ (Paris 1879); ‘Deniker, ‘Races of Man’ (London 1900); Bertillon and Chervin, ‘Anthropologie métrique’ (Paris 1909); Livi, ‘Antropometria’ (Milan 1900); Ranke, ‘Der Mensch’ (Leipzig 1911).

INDEX KEWENSIS, kū-ĕn'sĭs, a work of reference giving the names of flowering plants, compiled under the direction of Sir Joseph D. Hooker, director of the Royal Gardens at Kew, London, by Benjamin Daydon Jackson. With Bentham and Hooker's ‘Genera Plantarum’ as a basis for the limitation of genera a record was made of every genus and species of phanerogamous plants published up to 1885, and the geographical distribution of each species was indicated. To each name, whether retained or synonymic, full reference to its place of publication was added, retained names, and not necessarily the first specified name, being the earliest under which they were published in the recognized genus. A first supplement brought the work down to 1895; a second supplement covering the years between 1896–1900 appeared in 1905; and a third supplement in 1913 covered the years 1901–05. The index originated with Darwin, who supplied the funds for its operation. Its need arose from the difficulty found in identifying many plant species. The work of Hugh Falconer on Indian plants and of Marianne North in all parts of the world was of great value in adding scientific accuracy to this important work.

INDEX LIBRORUM PROHIBITORUM. The Index of Prohibited Books, commonly spoken of as the *Index*,— is a specific list of books which ecclesiastical authority prohibits Catholics from reading. This article will briefly give the history of the Index, the right of censorship claimed by the Catholic Church, and the exercise of that right.

I. History of the Index.— The first Roman Index appeared in 1559, under Paul IV, long after civil authority had instituted censorship and lists of prohibited writings. The latest Index is that of Leo XIII, a fifth edition of which was published in 1911, at the order of Pius X. Until recently this list of prohibited books was drawn up under the supervision of the Congregation of the Index; and a book was put on the Index by decree of the Congregation of the Roman Inquisition, or of the Holy Office, or of the Index. On 25 March 1917, Pope Benedict XV, by *Motu Proprio*, merged the Congregation of the Index into that of the Holy Office. Hence this latter Congregation, whose purpose is to safeguard Catholic teaching in faith and morals, now has charge of the editing of the Index. As a rule, the books contained in this authoritative list were written by Catholics. Precisely because the authors were in communion with the Church, explicit condemnation by a Roman Congregation was called for. On account of the relatively small Catholic population in English speaking countries, very few books in that language have been put on the Index. In the general laws of the Church, ample provision is made against the reading of non-Catholic books opposed to Catholic faith and morals. To read books that have been put on the Index or otherwise prohibited by the Holy See, one must obtain either a general or a particular permission from the competent ecclesiastical authority. As the Index is only one element of the legal practice of the Catholic Church in the matter of censorship, it is important here to state what right the Church claims in this sphere of her activity and how she exercises this right.

II. The Right of Censorship. (1) *In Civil Society.*— In every full formed society, the unitive principle is authority. This principle vivifies into a living whole, organizes into a social organic unity, the various elements that would else be independent, separate, disparate, hostile, mutually destructive entities. Authority has for its object those means, which are necessary to the very existence and well being of the social organism whereof it is the vitalizing and unifying principle. One such means is the censorship of the press. Legitimate authority, in every full formed society, may exercise censorship of the press, as a necessary means to the end for which the social organic unity exists. This censorship is twofold,— anticipatory or repressive,— according as it is exercised before or after the publication of the matter censored. By *anticipatory censorship*, the authority of a nation at war prohibits the publication of all news that may help the enemy, requisitions wireless stations, commandeers the cable and telegraph, censors private letters, and dictates what things shall not be published by the press. By *repressive censorship*, the same legitimate authority punishes as criminal the use of the mails for treasonable propaganda, and suppresses publications that have printed prohibited matter. All this obtains in civil censorship.

(2) *In the Church.*— Ecclesiastical censorship is like to civil, but in a different sphere of activity. The Catholic Church claims to be not a civil society, but a full formed spiritual society,— a social organic unity, whose members have the same spiritual aim, no matter how they are at variance in civil aims; a living social organism, unified and vitalized by the same principle of spiritual authority, no matter how they differ in the civil authority that unites them into civil societies. To the members of this spiritual society, supreme authority in matters of faith and morals is an attribute of the Pope, the successor of Saint Peter in the Apostolic See. Upon this supreme authority, as upon an adamantine rock, is builded the whole fabric of the Church; unto this supreme jurisdiction is granted the tremendous divine power of binding and loosing, to be exercised either directly or indirectly in regard to all who belong to the spiritual organic unity of the Church. "Thou art Kipha (a Rock), and upon this Kipha I shall build my Church; and the gates of hell shall not prevail against it. And I will give to thee the keys of the Kingdom of heaven. And whatsoever thou shalt bind upon

earth, shall be bound also in heaven; and whatsoever thou shalt loose upon earth, shall be loosed also in heaven.» (Matthew xvi, 18–19). This power of binding and loosing, be it vested supremely in the Pope or subordinately in any other member of the hierarchy, includes the right of both anticipatory and repressive censorship of printed matter, as a means necessary to the attainment of the spiritual end proposed by the Church.

III. Exercise of Censorship.— Catholics do not frown upon the exercise of this right of ecclesiastical censorship as tyrannical. They deem that, if there be in such repressive measures of the Church any *seeming* tyranny, it is the tyranny of love and not of hate. Just as a mother is narrow minded and will not allow her child to drink a solution of arsenic in water, merely because it looks harmless, so the Church is narrow-minded in protecting her children from poison in faith and morals. They may reject her motherly love, and give up membership in her community; but so long as they freely will to be her children and to share in the graces of her sacramental life, they must abide by her censorship in matters of faith and morals.

The ecclesiastical laws now governing censorship are given in the *Codex Juris*, canons 1384–1405. Twelve classes of prohibited publications are enumerated in canon 1399; they are all such as would lead to the poisoning of the wells of doctrine in the matter of faith and morals. In keeping these wells pure, ecclesiastical authority is only following out Saint Paul's injunction to Timothy: «Guard the glorious deposit (of faith) by the help of the Holy Spirit who dwelleth in us» (2 Timothy 1–14). The laws, by which ecclesiastical authority guards the deposit of faith are binding upon all Catholics. To prevent the reading of certain books, canon 2318 *Codex Juris* enacts the penalties incurred by violation of the more serious enactments of ecclesiastical censorship. They are ipso-facto excommunicated from the Church, who publish «books by apostates, heretics and schismatics, that defend apostasy, heresy or schism; likewise they who defend, or wittingly and without due permission read or retain such books or other books that have been *nominatim* prohibited by Apostolic Letter.»

Bibliography.— Hilgers, 'Der Index der verbotenen Bücher' (1904); 'Die Bücherverbote in Papstbriefen' (1907); Taunton, 'The Law of the Church' (1906).

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INDEX NUMBER, a statistical method of showing the changes in the value of money and of investigating and measuring variations in the prices of commodities in general or of a special group of the latter. An index number is the result of a combination of several items, each of which is a ratio between the price of a certain commodity at a particular time, and its price at another period which is taken as a standard. Such ratios are usually expressed as percentages. Thus the price of wheat in 1918 may according to a certain system be set down as 119, in comparison with its price from 1900 to 1910; that is the price of wheat in 1918 is to average price of wheat in the decade 1900–10 as 119:100. By some writers the term index number is applied to each item, as well as to the combination. Percentages are usually made by striking an average of them, but a result of equal generality is obtained from their sum. A good method of constructing an index number is to take a number of articles, say 25, compare the price of each at the current date with its price at the period taken as a basis or standard and express the result as a percentage, placing the sum of these percentages as the index number. Such a process involves the following considerations: what commodities are to be considered? How are prices to be ascertained? How are ratios between the prices of each at the current period and the basic period to be combined? These problems vary according to the purpose in view. A general plan is to include articles of consumption rather than materials or implements; retail prices should be used, not wholesale; general wages are excluded, but payments for personal services should be included. The proper combination of ratios is a weighted average. A general principle to be observed in assigning the weights is the importance of each to the consumer. A very extensive literature has grown up concerning index numbers and the problems arising from them. Both the British Association for the Advancement of Science and the International Statistical Institute have gone into the question thoroughly. The question at issue is what average should be used in combining the index numbers for the individual commodities. If the weighted arithemetic mean is used, the question is what weights are to be applied? Moreover, it is necessary to determine what commodities are to be included. *The Economist* table includes only 22, Sauerbeck 35, Falkner 223 and the United States Bureau of Labor 340. For these, in turn, various prices may be used (average prices or single quotations, wholesale or retail prices according to the plan followed), all of which again may depend on various sources such as trade journals, statements of merchants, government reports, etc. The standard year or standard period has also to be chosen. Mean index numbers may be utilized to determine other general tendencies besides the movement of prices. Thus the level of wages for large districts may be determined in this way, or the level of wages in a single great industry or special class of industries. The United States Bureau of Labor Statistics publishes an index number of wholesale prices and also indexes of retail prices. Consult 'Bulletin of the United States Bureau of Labor Statistics' whole No. 181 (October 1915, pp. 6, 10, 11, 257–263); Boyley, 'Elements of Statistics' (London 1901); Layton, W. T., 'Introduction to the Study of Prices' (London 1912); Secrist, Horace, 'Introduction to Statistical Methods' (New York 1917); Zizek, Franz, 'Statistical Averages' (New York 1913).

INDEX OF REFRACTION. See LIGHT.